2.0 Proposed Action and Alternatives

This chapter defines the GHPA boundaries, describes the existing and historic disturbances associated with uranium extraction present within the GHPA (Section 2.2, No Action Alternative), discusses the proposed development and activities that would occur during construction, operation, and decommissioning of the Project (Section 2.3, Proposed Action), and describes the alternatives analyzed in this document (Section 2.4, Resource Protection Alternative***, Section 2.5, BLM-Preferred Alternatives,*** and Section ***2.6,*** Alternatives Considered but Eliminated from Further Consideration). In developing the alternatives, the BLM followed guidance set forth in the BLM NEPA Handbook (H-1790-1), which provides for the development of a range of reasonable alternatives. Based on this guidance, the BLM developed the following alternatives for analysis in this EIS.

- **No Action Alternative:** This alternative assumes that approval of Cameco's Project is denied and certain existing infrastructure would be removed to release currently existing bonds. Exploration drilling would continue at a rate that would disturb less than 5 acres a year (Section 2.2, No Action Alternative).
- **Proposed Action Alternative:** This alternative consists of Cameco's ***Proposed Action (PoO)*** to develop 5 mine units and associated infrastructure within the GHPA to extract up to an estimated 2.5 million pounds of uranium oxide (U_3O_8) concentrate per year using ISR technology (Section 2.3, Proposed Action).
- **Resource Protection Alternative:** This alternative consists of Cameco's ***Proposed Action (PoO)*** with the use of closed loop drilling systems and modifications to reduce the environmental impact of the Project. Modifications include on-site processing of resin to produce slurry (Section 2.4, Resource Protection Alternative).
- ***BLM-Preferred Alternative: This alternative consists of Cameco's Proposed Action (PoO) with modifications to reduce the environmental impact of the Project. Modifications were derived from the RPA and input recovered through comments on the Draft EIS, and include annual development planning and construction timing constraints (Section 2.5, BLM-Preferred Alternative).***

The No Action Alternative and each of the action alternatives are discussed in terms of alternative-specific activities, alternative-specific design features, and surface disturbance summaries. Alternatives considered but eliminated from detailed analysis are discussed in Section 2.***6***, Alternatives Considered but Eliminated from Further Consideration. The impact analysis of each alternative in Chapter 4.0, Environmental Consequences, focuses on the new disturbance that would occur under each alternative. Analysis of the cumulative impacts to the region in Chapter 5.0, Cumulative Impacts, describes the incremental impact of Project disturbance when added to other past ***and*** present ***actions***, and reasonably foreseeable future actions ***(RFFAs)*** in the area.

2.1 Existing Infrastructure and Disturbance in the Gas Hills Project Area

The GHPA is located in central Wyoming (**Figure 1-1**). The majority of the GHPA, Sections 21, 28, 29, 33, 32, and portions of Section 31 in T33N, R89W; and Sections 5 and 11 and portions of Sections 1, 3, 10, and 12 in T32N, R90W, is located in Fremont County under the jurisdiction of the BLM Lander FO. The remainder of the GHPA (Sections 22, 27, and portions of Section 34 within T33N, R89W) is within Natrona County and under the jurisdiction of the BLM Casper FO. Portions of Section 6 of T32N, R89W also are within Natrona County but are under the jurisdiction of the BLM Lander FO (**Figure 1-1**).

2.1.1 Existing Infrastructure

Within the GHPA, approximately 131 acres currently are disturbed by existing roads, utilities, or structures (**Figure 2-1**). The Project would use and maintain portions of this existing infrastructure to support mining activities.

Two main roads exist within the GHPA, the AML ***R***oad (approximately 2.8 miles, or 17 acres) and the Carol Shop Road (approximately 5.8 miles, or 25 acres). The AML ***R***oad provides access to the site at its origin where it intersects the Dry Creek Road which traverses the Gas Hills Region from its intersection with Wyoming State Highway 136 to its eastern terminus at the Natrona county line (**Figure 2-1**). In addition to the main roads within the GHPA, many smaller, predominantly 2-track roads currently exist. Many of these are roads historically used for exploration drilling and ongoing grazing activities. These roads currently disturb approximately 28.3 miles (68.6 acres) within the GHPA.

One existing structure and associated disturbance, the Carol Shop facility, occupies approximately 27 acres within NE¼ of the SW¼ (NESW Qtr/Qtr) of Section 28, T33N, R89W. This structure is a large, multiple-bay building that was used as a maintenance shop for past uranium mining activities.

Approximately 2.8 miles of overhead power lines that historically supplied power to the Carol Shop facility and other historic mine areas currently are located in Sections 28, 29, and 33, T33N, R89W.

Several piles of topsoil, originally developed for eventual reclamation of the Carol Shop facility and main roads, are distributed throughout the GHPA and occupy approximately 3.1 acres.

A meteorology monitoring station was completed in December 2010 within the SW¼ of T33N, R89W, Section 28, on approximately 0.1 acre. This monitoring station may be in use as long as the anticipated 25-year life of the Project. Two deep disposal test wells were drilled in 2011 on approximately 4 acres.

2.1.2 Existing Disturbance

Of the approximately 8,500 acres within the permit boundary, approximately 15 percent, or 1,300 acres, has previously been disturbed by mining activities, mining exploration and off-highway vehicle (OHV) use (**Figure 2-1**). Vegetation has re-established on the majority of these lands (approximately 900 acres); existing roadways, structures, and the Buss I Pit Lake in Section 27 of T33N, R89 remain disturbed (approximately 400 acres). The revegetated areas generally have a diverse species composition, although some lands in the northern portion of the GHPA are primarily a monoculture (crested wheatgrass). Sources of disturbance primarily are related to mining and associated infrastructure, as described in the following section.

2.1.2.1 Historic Mining

From the 1950s to the early 1980s, much of the surface area within and adjacent to the GHPA was extensively mined for uranium employing both underground and surface mining methods. The majority of the uranium ore was recovered by surface mining methods. Additionally, exploration drilling and associated access road construction completed since the 1950s has disturbed portions of the GHPA. Many of the historical drilling access roads still exist.

Approximately 12,910 exploration boreholes have been drilled by Cameco and previous mineral rights owners within the GHPA since the 1950s; these boreholes were constructed and abandoned according to rules and regulations in place at the time. ***Approximately 2,500 of these wells were drilled before 1975, prior to establishment of well abandonment requirements.*** Numerous historical open-pit or underground mining operations were located within and adjacent to the GHPA.

A portion of 1 historic uranium mining operation, the Gas Hills East (Umetco Minerals Corporation), is located on portions of Sections 22, 15, and 16, T33N, R89W, directly adjacent to the GHPA. This location includes a cap over historic uranium tailings, which is visible in **Figure 2-1**. Management of this

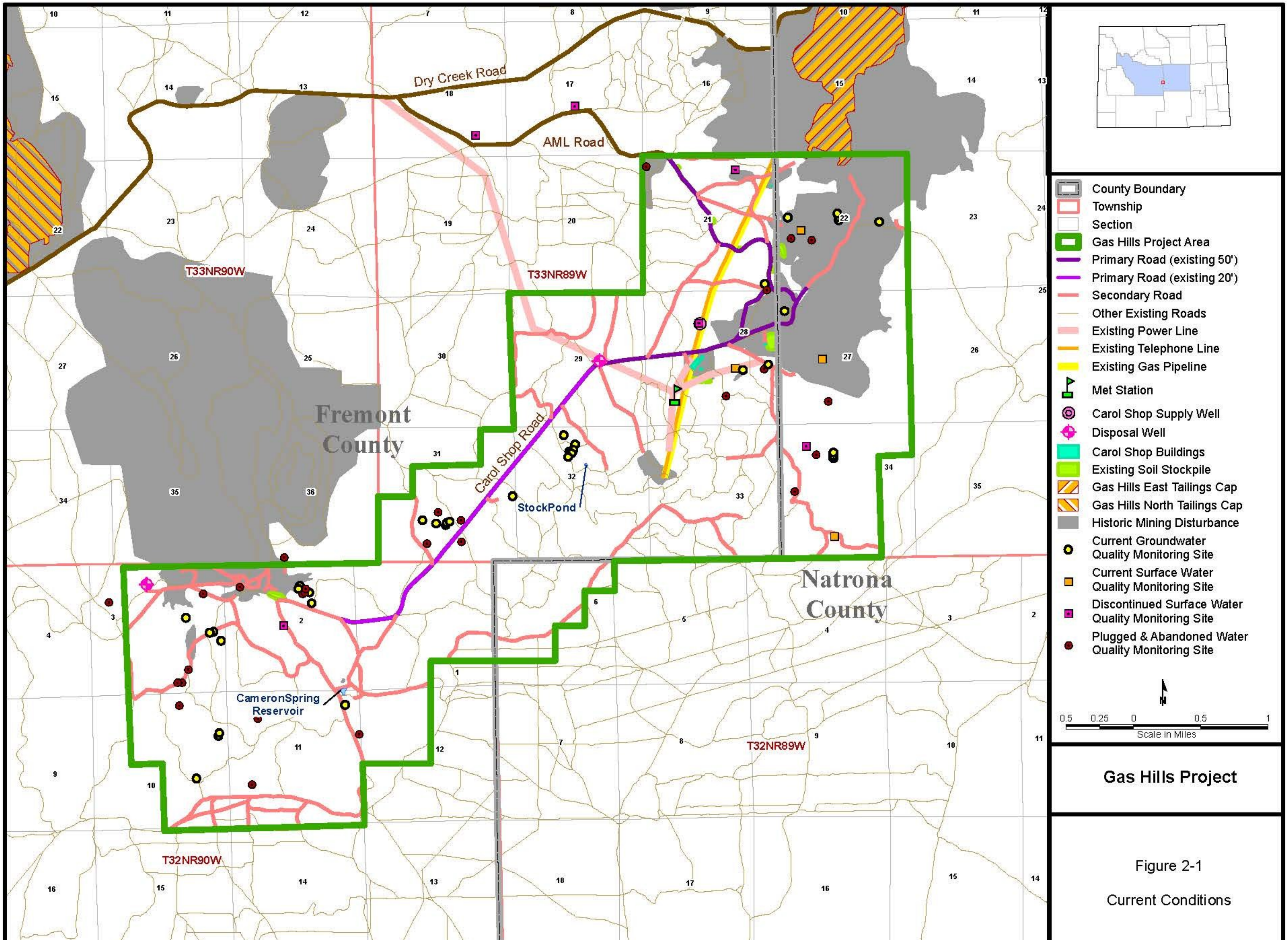


Figure 2-1

Current Conditions

capped area is currently being transferred to the ***DOE***, Office of Legacy Management (LM) under UMTRCA. Once transfer is complete the LM will implement a Long-term Surveillance Plan (LTSP), which will include inspection, monitoring, maintenance, and emergency measures designed to protect public health, safety, and the environment. ***Cameco's ability to access and develop some of their mining claims within the GHPA could be affected by management under the LTSP; however, f***or purposes of this EIS the BLM ***conservatively*** assumes that ***all surface disturbance disclosed in the Proposed Action would occur.***

The Lucky Mc (also called the Lucky Mac) mine operated between 1957 and 1988, as both an underground and open pit mine, and is currently owned by Pathfinder Mines Corporation. Portions of this mine is within the GHPA (Sections 25, 26, 27, 35, and 36 of T33N, R90W). Rehabilitation of the site began in 1991, and the ore processing facility was demolished in 1993. U.S. NRC determined that reclamation of mill tailings for the Lucky Mc (the Gas Hills North Tailings Cap) was complete in 2006. The site is not actively mined, and portions of the mine adjacent to the GHPA (in Sections 9, 10, 15, 21, and 22 of T33N, R90W) are currently being considered for transfer to LM under UMTRCA.

<u>Exploration Drilling</u>

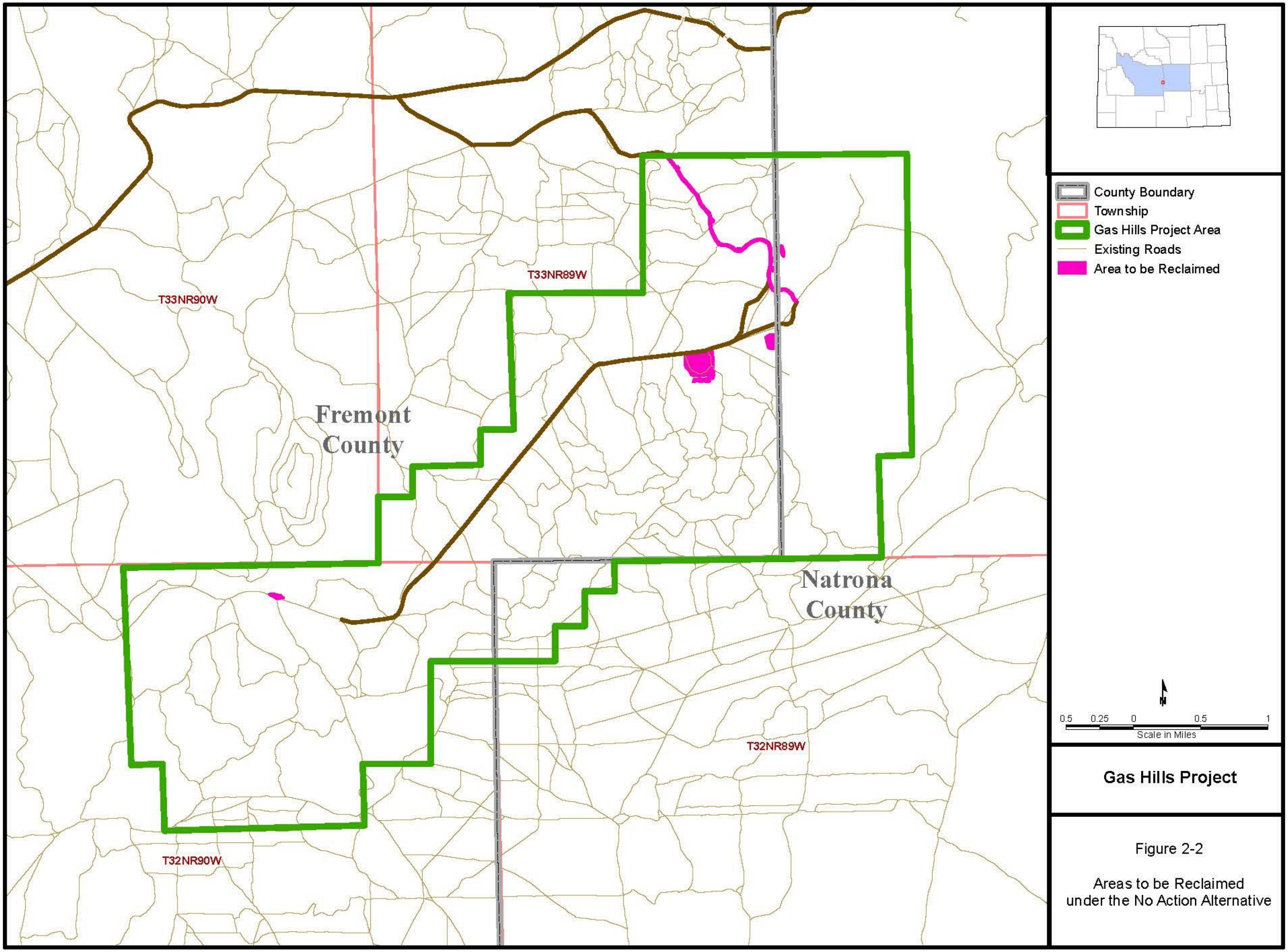
Almost 1,000 of the existing boreholes and wells in the GHPA were drilled and installed by Cameco between 1996 and 2010. Boreholes were abandoned according to applicable rules and regulations. No drilling occurred during 2005-2006. Reclamation of recent exploration drilling activity takes place on an on-going basis and typically is completed within 1 year of the initial disturbance. In September 2008, Cameco plugged and abandoned 12 inoperable site monitoring wells.

2.2 No Action Alternative

Under the No Action Alternative, none of the proposed uranium mining or associated activities would occur within the GHPA. Currently, Cameco would be responsible for the removal and reclamation of the existing Carol Shop facility and a portion of the AML ***R***oad running from the GHPA boundary in the NW¼ of Section 21, T33N, R89W to the Carol Shop (**Figure 2-2**). Reclamation would be required to meet performance obligations, currently secured by bonds, and would include the redistribution of topsoil currently stockpiled within the GHPA (**Figure 2-2**). Under this Alternative, the Carol Shop facility would be removed and approximately 26.7 acres of disturbance would be reclaimed. If no other need for the AML ***R***oad were determined, 1.8 miles also would be removed and approximately 10.9 acres (based on the current 50-foot disturbance for the road) would be reclaimed. Topsoil stored on approximately 2.6 acres would be redistributed on reclaimed areas. Existing notice-level activity within the GHPA also would be reclaimed. Under this alternative, a total of approximately 40.2 acres (less than 1 percent) within the GHPA would be reclaimed.

New disturbance associated with continued exploration activities could continue within the GHPA for any NOI accepted by the BLM for activities authorized under the 43 CFR 3809 surface management regulations. Exploration-related activities on BLM-managed lands may not result in over 5 acres of unreclaimed surface disturbance at any time during the life of the ***NOI*** filed for each action. Reclamation of these sites would be anticipated to occur within the same calendar year as the disturbance.

Analysis of the No Action Alternative is required under NEPA (43 CFR Section 1502.14[d]). The No Action Alternative may be selected by the BLM if the agency disapproves Cameco's PoO because the Project would cause undue or unnecessary degradation to resources managed by the agency (43 CFR, Section 3809.411[d][3][iii]).



Gas Hills Project

Figure 2-2

Areas to be Reclaimed under the No Action Alternative

2.3 Proposed Action

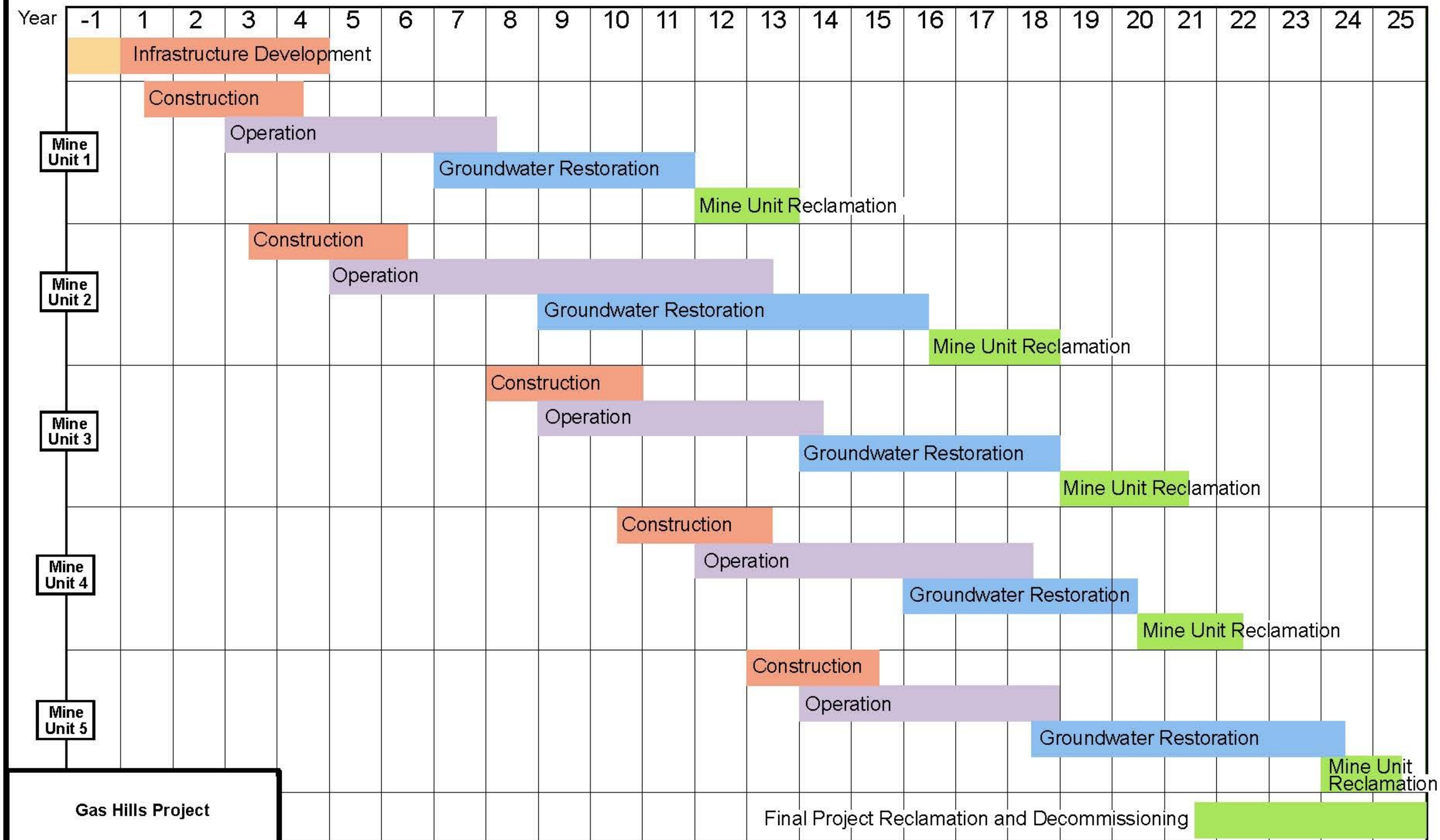
Cameco proposes the development of uranium deposits in the GHPA through implementation of the ISR process, which involves recovery of uranium from the subsurface through chemical dissolution using wells constructed similarly to conventional water wells (Proposed Action). The process requires installation of surface infrastructure (processing facilities, waste water disposal facilities, roads, header houses, and power lines) as well as subsurface infrastructure (wells, pipelines, electrical lines, and communication cables). Activities associated with the Proposed Action would occur throughout the projected 25-year span of the Project, and would include the following phases:

1. **Infrastructure Development** – Construction or improvement activities occurring within the GHPA, but outside of mine units, including: upgrades to Project infrastructure within the GHPA (roads, electrical lines, water disposal, and pipelines); and construction or upgrades to processing facilities (Section 2.3.1, Infrastructure Development)
2. **Mine Unit Construction** – Construction activities occurring within mine units, including: delineation drilling; installation of injection, production and monitoring wells, pipelines, booster pump stations, header houses, and roads to header houses (Section 2.3.2, Mine Unit Construction).
3. **Mine Unit Operation** – Operation of the ISR process to remove and process uranium; interim reclamation of the majority of the mine unit construction disturbance (Section 2.3.3, Mine Unit Operation).
4. **Mine Unit Restoration and Reclamation** – Restoration of groundwater; and decommissioning and removal of mine unit infrastructure and final surface reclamation within each mine unit (Section 2.3.4, Personnel/Workforce).
5. **Final Project Reclamation and Decommissioning** – Decommissioning and reclamation of surface and subsurface infrastructure within the GHPA but outside of the mine units, such as evaporation ponds, roads and satellite facilities (Section 2.3.5, Mine Unit Restoration and Reclamation).

Descriptions of the various aspects of the Project are derived in part from the Revised PoO (PRI 2011a) and Cameco's WDEQ mine permit update – Permit 687 (PRI 2009). General descriptions of ISR project components were derived from the U.S. NRC's Generic EIS for ISR facilities (U.S. NRC 2009***b***) in addition to the information in the WDEQ mine permit update. These activities may occur simultaneously while different mine units are constructed, operated, and reclaimed during the span of the Gas Hills Project (**Figure 2-3**).

For the purpose of analysis ***within this document,*** it is assumed that the surface within a mine unit would be completely disturbed during construction activities, although it is possible that small patches of vegetation may be left intact. See **Appendix *B***, **Figure *B*-1** for a typical mine unit pattern. Surface disturbance within a mine unit would be phased over several years at a rate that would depend on the uranium production rate and the availability of mine construction equipment and personnel. During operations, approximately 95 percent of the mine unit would undergo interim reclamation, and the remaining 5 percent would remain disturbed during operations for roads, header houses, well heads, and power lines. Access to well heads during mine unit operation would cause compaction and disturbance on an estimated 45 percent of the mine unit, for a total disturbance of 50 percent. The mine unit surface would again be completely disturbed during mine unit decommissioning, after which the mine unit would undergo final reclamation. Final reclamation would include plugging and abandoning all wells, removing header houses and buried piping, and re-grading and seeding the disturbed surface.

The surface disturbance associated with facilities within the GHPA but outside of mine unit boundaries, such as evaporation ponds, wastewater deep disposal wells or mineral processing and water treatment facilities, would remain for the projected 25-year life of the Project. At the end of the Project, all of these



Gas Hills Project

Figure 2-3

Project Activity Schedule

Source: PRI 2009, Figure OP1-3.

facilities would be decommissioned or removed and disturbed areas would be reclaimed to the pre-mining land use. Disturbances associated with the Proposed Action are summarized in **Table 2-1**.

2.3.1 Infrastructure Development

2.3.1.1 Satellite Facilities

The proposed satellite facilities would be centrally located buildings containing equipment for preparing ISR solutions, as well as the ion-exchange equipment for stripping uranium and other materials from water used in the ISR process. Cameco proposes to use the existing Carol Shop facility for the first satellite facility to be developed for the Project. The existing building would be upgraded to house the central water treatment facility, ion-exchange columns, associated equipment and piping, offices, and maintenance facilities. One additional satellite facility would be constructed to house additional ion-exchange, resin loading and unloading, and future reverse osmosis (RO) capacity located at either of 2 possible satellite locations, as shown in **Figure 2-4**. While Cameco may decide not to build the additional satellite facility, the BLM has assumed Cameco would construct 1 additional facility at 1 of the 2 possible locations, both of which are analyzed in this EIS.

2.3.1.2 Waste Management

<u>Wastewater Disposal Facilities</u>

Water from which uranium has been removed using ion-exchange equipment may be re-used in the ISR mining process or be disposed of during mine operation. Liquid waste produced during operations primarily would be from process wastewater streams consisting of well-field bleed, RO brine fluids, and satellite washdown water.

Cameco proposes 2 water disposal methods for use in the Proposed Action. ***One*** method would be disposal into solar evaporation ponds that would be designed and constructed to contain the water volume to be disposed of during Project operation. Evaporation ponds would be lined, the perimeter would be bermed to prevent run-on of surface drainage and fenced to exclude wildlife and ***livestock. Ponds*** would be located similarly to those shown in **Figure 2-4**. Topsoil excavated from the ponds would be segregated and stockpiled in long-term topsoil stockpiles. Evaporation ponds would be fenced following BLM Handbook H 1741-1 standards to prevent both livestock and large game animals from accessing the ponds. Although ***Cameco does*** not anticipate ***that waterfowl would*** use the evaporation ponds, Cameco ***would coordinate with*** the ***WDEQ, BLM, WGFD, and the USFWS to identify*** and implement measures to remove, exclude, or deter ***waterfowl use****.*

The evaporation ponds would be designed to ***comply with applicable WDEQ, U.S. NRC, and USEPA regulations, and would*** operate in ***paired*** impoundments during regular operation, where the excavated materials would be piled above-grade for additional storage capacity, surface water isolation, and freeboard requirements. See **Appendix *B***, **Figure *B*-2** for more specific pond design. Ponds would be operated essentially at one-half capacity to allow for the evacuation of ***a*** pond's contents into its partner in the event that a pond requires servicing.

According to the USEPA, the proposed Project must comply with the requirements of 40 CFR Part 61 Subparts A and W. The USEPA states that 40 CFR Part 61 Subpart A requires the submittal of a Construction Approval Application for impoundments (ponds) prior to construction or modification, in accordance with 40 CFR 61.07. 40 CFR Part 61 Subpart W allows for no more than two impoundments, each no more than 40 acres. No new impoundment can be built unless it meets the work practice regulatory standards in Subpart W and is granted a construction approval from the USEPA. 40 CFR 61.252(b)(1) requires that the impoundments must meet the design requirements of 40 CFR 192.32(a) (e.g., double liner, leak detection.)

Table 2-1 Proposed Action Disturbance Summary

Mine Component	Disturbance (acres)	
	Construction/ Decommissioning (+15 percent)[a]	Operation (+15 percent)[a]
Mine Unit Disturbance, Including Monitoring Well Ring		
Mine Unit 1[b]	156 (179)	78 (90)
Monitoring well ring for Mine Unit 1[c]	11 (13)	6 (7)
Mine Unit 2[b]	365 (420)	183 (210)
Monitoring well ring for Mine Unit 2[c]	10 (12)	6 (7)
Mine Unit 3[b]	90 (103)	45 (52)
Monitoring well ring for Mine Unit 3[c]	10 (12)	6 (7)
Mine Unit 4[b]	255 (293)	128 (147)
Monitoring well ring for Mine Unit 4[c]	9 (10)	5 (6)
Mine Unit 5[b]	111 (127)	56 (64)
Monitoring well ring for Mine Unit 5[c]	8 (9)	4 (5)
Subtotal for Mine Unit Disturbance	**1,025 (1,178)**	**517 (595)**
Project Infrastructure Outside of Mine Units		
Roads/Utility Corridors[d]	209	38
Surface Facilities		
Carol Shop Facility[e]	0	0
Satellite Facility[f]	10	10
Evaporation Ponds and Diversions[g]	62 (66)	62 (66)
Disposal Wells[h]	6	3
Topsoil Stockpiles	3	3
Subtotal for Disturbance Outside of Mine Units	**290 (294)**	**116 (120)**
Grand Total	**1,315 (1,472)**	**633 (715)**

[a] Mine unit area may expand based on results of delineation drilling; to account for this possible expansion, disturbance estimates for mine units and their associated monitoring well rings are conservatively increased by 15 percent.

[b] Disturbance of the entire mine unit is anticipated during construction and decommissioning. Operational disturbance for facilities (primary and secondary roads, header houses, valve boxes, and well heads) is conservatively estimated to be 5 percent of the mine unit area. The remaining 95 percent of the mine unit would undergo interim reclamation for the duration of operations; however, an estimated 45 percent of the mine unit would be impacted by cross-country mechanized travel to well heads, for a total of 50 percent disturbance of a Mine Unit during operation.

[c] Construction disturbance for monitoring well rings is based on a disturbance width of 18 feet. Operational disturbance for monitoring well rings is based on a disturbance width of 10 feet.

[d] Road/utility corridor construction disturbance for new, existing, and upgraded existing roads is based on a width of 60 feet for primary roads, 40 feet for secondary roads, 50 feet for underground utilities, and 30 feet for overhead power lines. Road/utility corridor operational disturbance based on a width of 30 feet for primary roads and 15 feet for secondary roads; utility corridors would undergo interim reclamation during operations. Includes disturbance for approximately 1.4 miles (8.3 acres, based on a 50-foot-wide disturbance) for a process water pipeline that would not be adjacent to a proposed road.

[e] The Carol Shop facility is located on 27 acres of existing disturbance and would not involve new disturbance under the Proposed Action.

[f] Conservatively includes the disturbance for both proposed satellite facility locations although only 1 would be constructed. Disturbance for each location (approximately 5 acres) includes the building plus additional area for parking and access.

[g] Disturbance associated with evaporation ponds 1 and 2 could each be increased by 2 acres for a total disturbance increase of 4 acres to accommodate additional evaporative surface area.

[h] Based on disturbance of 2 acres for construction and 1 acre for operation of each of 3 proposed disposal well locations. Two deep disposal test wells were drilled in 2011; further development will require re-disturbance.

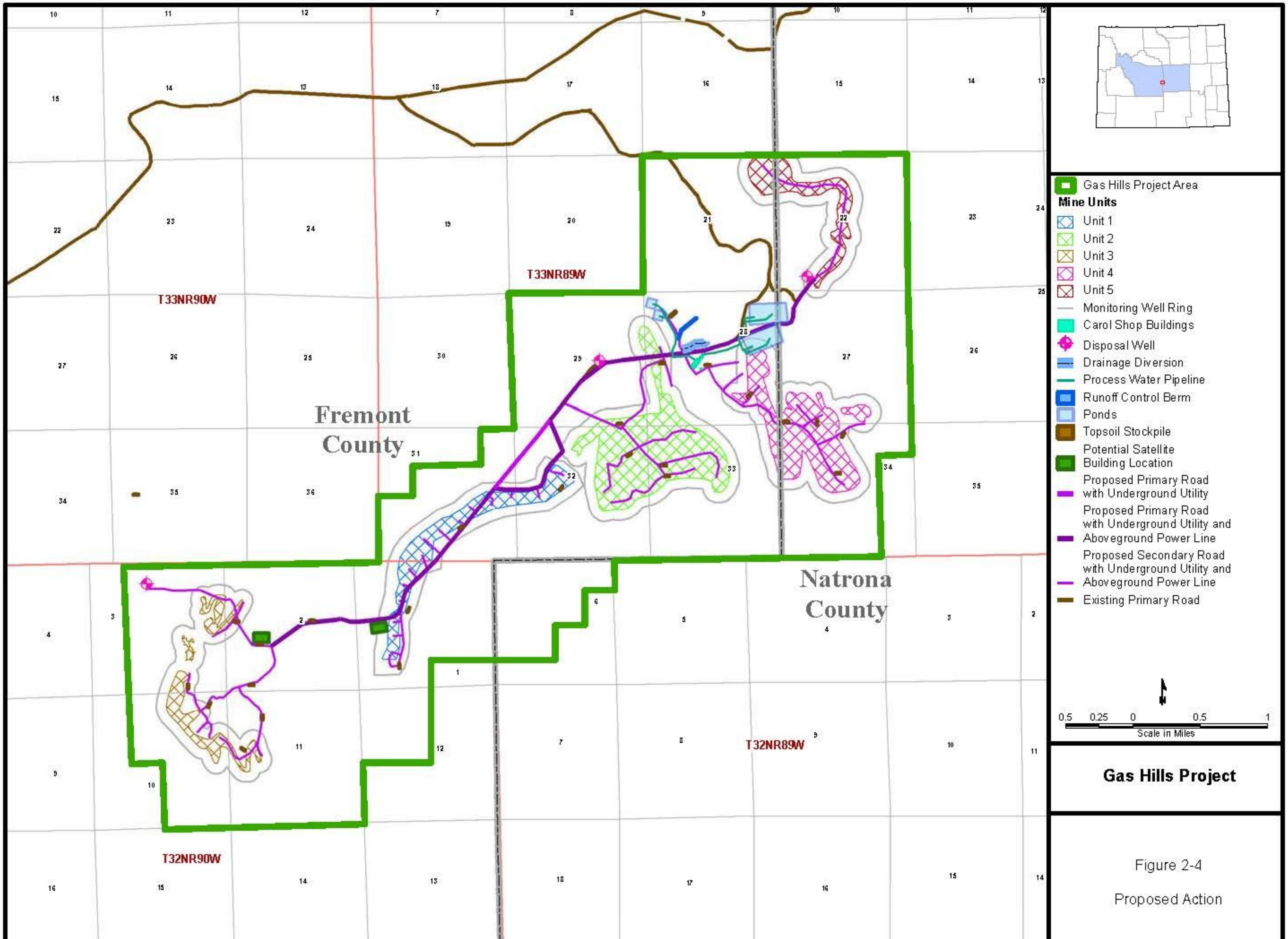


Figure 2-4

Proposed Action

The BLM does not have regulatory authority for 40 CFR Part 61 and therefore does not make any determination as to its application to evaporation ponds used in ISR mining/milling. As a surface management agency, the BLM analyzes the potential impacts associated with the surface disturbance associated with constructing evaporation ponds but makes the assumption that the appropriate regulatory agency authorization will determine the appropriate design and regulatory requirements.

The BLM assumes that the amount of surface disturbance associated with the ponds (and however they are accessed) will not exceed the amount of surface disturbance analyzed here and may be less. If subsequent permitting by other regulatory authorities identifies a need for revision of Cameco's PoO, the BLM will review the changes to determine if they are within the range of alternatives analyzed in this document, and whether this NEPA document is adequate or needs to be amended or supplemented.

Each evaporation pond would be lined with a ***primary drain liner of*** 60 millimeter high density polyethylene ***(HDPE)*** (or equivalent) ***and a secondary liner of 40 millimeter HDPE (or equivalent). The underlying surface of the pond would be constructed with a minimum of 3 feet of compacted soil with a maximum coefficient of hydraulic conductivity of*** 1×10^{-7} ***centimeters/second when compacted.*** Leak detection ***consisting of a network of perforated piping*** would be situated between the ***primary and secondary*** liners with gravity flow to ***a leak detection well, where any leaking fluid could be collected and sampled. The leak detection system would be constructed of materials chemically resistant to pond fluids, and of sufficient strength to prevent collapse under the pressure of the pond fluids.***

The evaporation ponds, berms, surface water diversions, storm water control measures, and leak detection inspection manhole would be visually inspected daily. The manhole sump pump would be tested at least once every two weeks. In the event the sump pump is observed operating, a water sample would be collected and analyzed for chloride, bicarbonate, and conductivity. If the analysis indicated the ponds to be leaking, the contents of the leaking pond would be transferred into another pond, the U.S. NRC and WDEQ-LQD would be notified within 48 hours and a written report would be submitted within 60 days. An investigation would be conducted to determine the source of the leak, and once identified, the leak and any damage to the system would be repaired. Additional testing and sampling would continue when pond operation resumed, and a final written report would be submitted describing all remedial and repair activities within 60 days after repairs have been completed (PRI 2009).

To augment the solar evaporation pond capacity over time, forced evaporation and crystallization equipment would be added within the Carol Shop facility at the beginning of operational Year 6. The distillation and crystallization process would heat the wastewater feed to the boiling point; the steam would be allowed to cool resulting in a condensate of distilled water. The distilled water would be consumed in the plant, used as a source of restoration water, used for mine unit hydrologic control, or stored in ponds. Waste brine generated by the evaporator would be transferred to the crystallizer where it would be heated to drive off residual moisture and reduced to a dry solid that ***could be disposed of at an off-site facility.***

Waste brine treated to a dry solid would be classified as an 11e2 waste that must be disposed of at an NRC- or NRC-agreement State-licensed facility. With the addition of a second forced evaporation unit, the waste solids generated would be the equivalent of 1.2 truck loads per day. Disposal of these solids would be by transportation to an NRC- or NRC-agreement State-licensed facility near Blanding, Utah.

Another method would be disposal of waste water through the use of one or more Class I injection wells (wells that inject industrial or municipal non-hazardous wastes below the deepest underground source of drinking water) for deep injection of wastewater.

Cameco is evaluating whether deep disposal wells are technically feasible by drilling to the target geological formation, and testing the formation's ability to receive the desired volume of water. ***Deep disposal wells are often called deep injection wells, but the term deep disposal well is used in their document to distinguish them from injection wells used in the ISR process. Three candidate test well locations for deep disposal wells have been identified and two wells have been drilled (Figure 2-4).*** Two deep disposal test ***wells, the Gas Hills #1 and the Gas Hills #2,*** were drilled in 2011 ***and 2012. The wells were temporarily permitted as Class V disposal wells for*** testing***. Water samples were taken from the Flathead Formation in each well and water quality tests were conducted on the samples. No other test results have been completed to date. Other injection disposal candidate*** formations ***allowed by permit*** include the Cloverly, Morrison, Nugget, Phosphoria, Tensleep, ***and*** Madison formations which range in depth from ***1,400*** to over 4,000 feet ***(WDEQ-WQD 2011a). The Flathead Formation was encountered at a depth of 3,444 feet in Gas Hills #1 and at a depth of 5,116 feet in the Gas Hills #2. The results of analyses of water samples from the Flathead Formation were as follows: Gas Hills #1, 3,080 mg/L TDS; Gas Hills #2, 3,220 mg/L TDS (Subsurface Technology, Inc. 2012).***

If a deep disposal well for wastewater is technically feasible, Cameco would apply for a permit from WDEQ-WQD ***as the delegated lead agency*** to employ deep wastewater injection as the primary means of water disposal. Use of deep disposal wells for wastewater would reduce the volume of solid material in evaporation ponds that would eventually require disposal at off-site permitted facilities as discussed ***earlier in this section. For purposes of analysis in this EIS, the BLM has assumed that both disposal methods for waste water would be developed for the Project.***

The water quality testing results from the wells indicate that the Flathead Formation may be an Underground Source of Drinking Water (USDW) by USEPA or WDEQ-WQD based on TDS. A USDW is defined as an aquifer or portion of an aquifer:

- ***Which supplies any public water system; or***
- ***Which contains a sufficient quantity of groundwater to supply a public water system; and currently supplies drinking water for human consumption; or contains fewer than 10,000 mg/L total dissolved solids; and***
- ***Which is not an exempted aquifer.***

The permit application process must consider aquifers (and portions of aquifers) that do not currently supply water to a public water supply but are capable of producing that quantity of water.

It is possible to obtain an exemption from WDEQ-WQD (with concurrence from USEPA) to inject into a USDW based on the following criteria from 40 CFR 146.4 if:

- ***The aquifer does not currently serve as a source of drinking water within a defined radius of the disposal.***
- ***It cannot now and will not in the future serve as a source of drinking water.***
- ***The TDS content of the groundwater is more than 3,000 mg/L and less than 10,000 mg/L, and the aquifer is not reasonably expected to serve as a public water supply.***
- ***The disposed water will not migrate outside of the exemption boundary.***
- ***Additionally, if the USDW proposed for injection is found to be at or below 3,000 mg/L TDS, approval of such an exemption would be considered a substantial revision to the WDEQ-WQD UIC program and require rulemaking signed by the USEPA Administrator.***

If the Flathead is determined to be a USDW, conversion of Class V test wells to Class I UIC disposal wells would require aquifer exemptions for a portion of the Flathead Formation. Approval of an aquifer exemption removes a portion of a USDW from protection under the Safe Drinking Water Act. In addition, if waste fluid is planned to be injected into any of the formations above the Flathead through a Class I UIC well, a determination would need to be made as to whether these formations are USDWs and if they are, aquifer exemptions would be needed.

Monitoring and testing requirements for Class I wells include the following (USEPA 2012):

- ***Continuous monitoring of annulus pressure (to detect leaks in the casing, tubing, or packer; and any fluid movement into a USDW).***
- ***Containment in the injection zone.***
- ***Laboratory characteristics of injected waste.***
- ***Part I and Part II mechanical integrity tests every 5 years.***

In addition to the monitoring requirements, there are record keeping requirements which include the following:

- ***Quarterly on injection pressures, volumes, and injected water types.***
- ***Changes to the facility, progress on compliance schedule, loss of mechanical integrity, or noncompliance with permit conditions.***

If testing of the first ***two*** well***s*** indicates that ***they*** would be suitable for injection of wastewater, Cameco would permit the well***s*** for disposal, and would drill ***1*** additional disposal well at ***the*** alternate location ***shown on Figure 2-4***. For purposes of analysis in this EIS, the BLM has assumed that both water disposal methods would be developed for the Project.

Hazardous Materials

Any hazardous or toxic materials used for uranium processing would be handled, stored, and/or disposed of in accordance with state and federal hazardous materials requirements and pursuant to standard operating procedures.

Storm Water

Construction disturbances and associated potential for the discharge of pollutants in the form of surface materials and sediment into Waters of the State (defined as all surface ***water*** and groundwater, including waters associated with wetlands, within Wyoming) via storm water runoff would be controlled using Best Management Practices (BMPs) as described in Cameco's Gas Hills Project Storm Water Pollution Prevention Plan (SWPPP). The SWPPP was prepared as part of the Gas Hills WDEQ-WQD General Permit No. WYR103870 to discharge storm water associated with large construction activity under the Wyoming Pollutant Discharge Elimination System. The SWPPP would be modified with any change in design, construction, operation or maintenance that may change the potential for the discharge of pollutants into Waters of the State. A copy of the SWPPP currently is maintained at the Gas Hills site. When operations commence at the GHPA, this construction permit would be converted to an industrial activity permit.

Sewage

Domestic sewage also would be produced and would be handled by conventional septic/leach field systems. In addition to the existing system at the Carol Shop facility, other systems would be constructed at alternate satellite locations. These systems would be intended to receive non-contaminated wastes from restrooms, shower facilities, and miscellaneous sinks located within the Project facilities. ***W***ater for the Carol Shop facility ***is supplied by an existing industrial well. If more commercial fresh water is***

needed during the life of the Project, Cameco will drill a new well, permitted by applicable state and federal agencies. Temporary chemical toilets would be used in well-field and drilling areas when use of the satellite facilities is time consuming or inconvenient. ***Potable water would be hauled in from off-site sources.***

Solid Wastes

During operations, non-contaminated wastes as defined by the AEA would include office and food wastes, paper and wood products, and steel. These wastes temporarily would be stored on-site and periodically transported to a municipal landfill by a contract waste disposal operator.

Radiologically contaminated wastes would be generated during the uranium recovery operations. These wastes would include process pipe and equipment, tanks and vessels, ion-exchange resin, filter media, and the solid residue and liners from the evaporation ponds. ***Wastes would temporarily be stored on-site, either within a designated area in an unused evaporation pond, or within the area associated with the Carol Shop facility.*** An estimated maximum of 300 cubic yards ***(cy)*** of contaminated waste could be generated per year by the Project. Cameco currently has a contract disposal agreement with Denison Mines to dispose of these Gas Hills byproduct wastes at their Blanding, Utah, facility.

2.3.1.3 Access Roads

Existing major roadways would provide access to the GHPA, and new or upgraded existing roads would provide access within the GHPA between the 5 mine units. Three types of roads would be used during Project construction and operation: primary and secondary roads would be constructed, graveled, and maintained for the use of the Project and would be designed for designated speed limits; and 2-track roads would be developed for light use, primarily as access to perimeter monitoring wells surrounding mine units. The BLM would require that ***primary*** roads ***within the GHPA*** be built to BLM standards (The Gold Book, USDOI and USDA 2007), which include road grade less than 8 percent, except for pitch grades of less than 300 feet.

The Carol Shop Road would be the primary road within the GHPA, with a speed limit of 40 miles per hour (mph). Year-round access to and from the GHPA would be over existing State Highway 136 (also known as the Gas Hills ***Highway***) from Riverton, Wyoming, to the Dry Creek Road, connecting with the Carol Shop Road (**Figure 2-5**) via the AML ***R***oad. ***Other*** access ***routes*** to the GHPA would ***include*** Fremont County Road No. 5 (also known as the Ore Road or Haul Road) from Jeffrey City to the Dry Creek Road, ***and*** Natrona County Road No. 212 (also known as the Gas Hills Road or Waltman Road) from Waltman to the Carol Shop Road**. *Currently, portions of the Dry Creek Road are not maintained under the jurisdiction of any public entity (e.g., BLM, Fremont County, or WYDOT).*** All ***Project*** vehicles travelling on public roads would comply with the Wyoming Highway Department's Rules and Regulations. As each mine unit is delineated, designed and developed, secondary access roads would be required to provide access to each of the header houses within the mine units.

Access to well heads and monitoring wells within mine units would be cross-country; no grading for this access would occur except in areas where the slope exceeds 25 percent. ***Drilling on slopes greater than 25 percent would occur infrequently.***

Roads would be constructed as shown in **Appendix *B*, Figure *B*-3** for typical road construction details. Primary and secondary access roads would use culvert crossings at significant drainages (see **Appendix *B*, Figure *B*-4** for a typical culvert installation). Primary access roads would be 30 feet wide with a 60-foot right-of-way (ROW), and secondary access roads would be 15 feet wide with a 40-foot ROW. Most traffic at the Project site would be limited to pick-up trucks and typical over-the-road drill rigs, flatbed trucks, and other similar vehicles. Reduced speed limits would be posted and maintained on access roads for employee safety and to minimize the potential for collision with wildlife.

Gas Hills Project

Figure 2-5

Transportation Routes

Pipelines

Underground pipelines would be installed between the satellite and water disposal facilities (both evaporation ponds and disposal wells). Pipelines also would be installed between the satellite facilities and the header houses at the mine units within existing or proposed road ROWs.

If large, inflexible, or multiple pipelines are placed in a trench, Cameco would construct the pipeline trench with an excavator or backhoe and would stockpile, and then immediately replace the topsoil. In some cases, and where small flexible pipe is installed, Cameco would use a trenching machine or spider plow. These types of machines do not require topsoil segregation and reduce the overall disturbance footprint and intensity.

2.3.1.4 Power Lines

Approximately 2.8 miles of existing aboveground power lines are adjacent to the Carol Shop road from the northern boundary of the GHPA terminating near the Carol Shop facility. Approximately 21.1 miles of new aboveground power lines would be constructed within proposed or existing ***primary and secondary*** road ROWs from the existing power lines to each of the header houses within the mine units. New ***aboveground*** power lines would be constructed to minimize potential electrocution hazards to raptors by following the guidance in "Suggested Practices for Raptor Protection on Power Lines - The State of the Art in 2006," by the Avian Power Line Interaction Committee (APLIC) (2006). ***New power lines between header houses and individual wells within mine units would be buried within the area disturbed during mine unit construction.***

2.3.1.5 Water Use

All water used for the Project would be obtained from groundwater within the GHPA appropriated in accordance with state requirements. Surface ***water*** and groundwater rights appropriations in the area historically have been used for livestock watering, by wildlife, and for limited non-industrial domestic purposes associated with past mining operations. No public water supply wells or intakes are located within the GHPA.

Table 2-2 lists the estimated water volumes to be used by the Project ***for uranium production and groundwater restoration*** over the life of the planned operations. It is estimated that the maximum annual volume of groundwater that would require disposal over the life of the Project would be ***445*** acre-feet. This water would be disposed of using methods described in Section 2.3.1.2, Waste Management, of this document.

Table 2-2 Projected Water Disposal

Year of Operation[a]	Water Flow[b] *(acre-feet/year)*[c]	Water Consumed *(acre/ft/year)*[d]
1	4,516	***13***
2	9,033	***40***
3	11,452	***40***
4	13,711	***40***
5	15,324	***244***
6	15,969	***406***
7	18,550	***445***
8	19,195	***445***

Table 2-2 Projected Water Disposal

Year of Operation[a]	Water Flow[b] *(acre-feet/year)*[c]	Water Consumed *(acre/ft/year)*[d]
9	18,388	***445***
10	17,420	***445***
11	16,614	***445***
12	16,130	***445***
13	15,646	***445***
14	***12,581***	***436***
15	***10,001***	***419***
16	***6,936***	***411***
17	***4,839***	***406***
18	***3,387***	***403***
19	***2,420***	***400***
20	***1,774***	***73***

[a] Year of operation is based on the first full year of ISR mining and does not include the period for ***installation of the first mine unit to be constructed*** or for construction of Project infrastructure.

[b] Volume of water per year circulated through the Project infrastructure and the subsurface ore zone to extract uranium from the subsurface and to accomplish groundwater restoration. Most of this water would be recycled through the system multiple times. ***This does not include water used for delineation drilling.***

[c] ***One acre-foot is equivalent to approximately 325,851 gallons.***

[d] Volume of water per year that would be disposed of each year of system operation. This volume would constitute consumptive use by the Project.

Source: Table OP3-3, Operations Plan (PRI 2009).

2.3.2 Mine Unit Construction

Construction of each mine unit would involve disturbance of the entire mine unit ground surface for the following activities, each of which are described in greater detail later in the section:

- Delineation drilling to refine ore body limits;
- Hydrologic testing;
- Installation of injection, production, and monitoring wells;
- Construction of primary and secondary access roads within mine units, and installation of underground utilities (piping, power lines, communication cables); and
- Construction of header houses.

Surface disturbance within each mine unit would not occur all at once but would be sequenced over several years, depending on the uranium production rate and on the availability of mine unit development and construction equipment and personnel. Cameco anticipates it would take 2 to 3 years to complete the construction of a mine unit, including injection/production wells, pipeline/electrical power corridors, header houses, and access roads associated with a given mine unit. Each mine unit would be constructed ***sequentially as presented in Figure 2-3.*** Cameco would not have more than ***two*** mine units in production at any time ***and*** would not begin production in *t**he fourth mine unit constructed*** until groundwater restoration (as described later in this document in ***Section*** 2.3.5.1, Groundwater Restoration) ***in the first mine unit to be constructed*** was completed. **Appendix *B*, Figure *B*-1** illustrates a typical ***well field*** pattern installation ***within a mine unit*** consisting of injection wells, production wells, monitoring wells, pipelines, access roads, power lines, and a header house.

In addition to truck-mounted rotary drill rigs and water trucks, other equipment employed during mine unit construction would include truck mounted pump pulling units, truck-mounted hose reels, electrical generators, backhoes, and light duty 4-wheel drive vehicles. **Figures 2-6** and **2-7** show typical arrangement of the vehicles during the 3 to 5 days it generally takes to drill each well. Mine unit construction also would require the use of temporary cement batch plants within mine units to support well and header house installation. Additional ancillary construction material would be contained within the Carol Shop facility or mine unit disturbance areas.

2.3.2.1 Delineation Drilling

The shape, distribution, and grade of the uranium deposits determine the location and shape of mine units, as well as ***well field design,*** the final injection or production well placement, well density, and the resulting supporting facilities (e.g., roads and pipelines). To determine the extent of the deposits, multiple test holes would be drilled in a process called delineation drilling, which would determine the final location of ISR wells. The surface disturbance footprint for all delineation boreholes would be within each mine unit (see assumptions in **Table 2-1**). Delineation drilling would occur throughout each year, depending on production and development needs. Typically, 200 to 500 delineation drill holes would be completed each year.

Delineation holes would be constructed using truck mounted rotary drill rigs and water trucks (**Figures 2-6** and **2-7**). Materials removed from the boreholes during drilling (drilling mud) would be collected in temporary pits (drilling mud pits). The drilling mud pits would be fenced until the contained fluid has been removed or has evaporated and the pits have been ***refilled****.* Topsoil from drill holes and drilling mud pits would be salvaged and placed in short-term stockpiles.

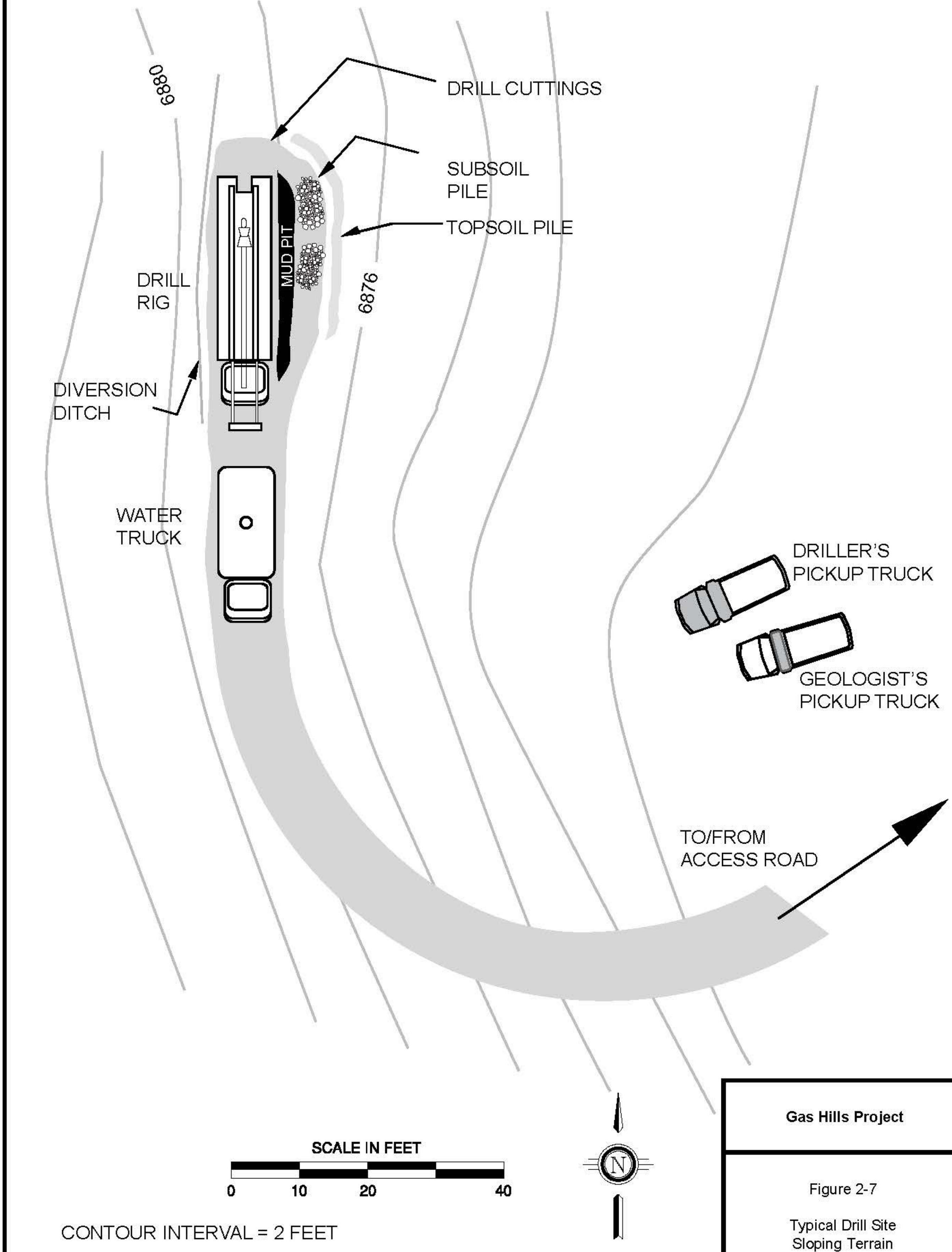
An average of 14 drill rigs are anticipated to operate on-site simultaneously for delineation drilling. Once information from each borehole is gathered and logged, it would be plugged and abandoned.

The drilling mud pit would be allowed to dry out for several days prior to backfilling. Prior to drill hole abandonment, techniques such as siphoning the water from the pit back into the drill hole or removing excess water from the pit for use at other drill sites may be used to expedite drilling mud pit reclamation. After backfilling the drilling mud pits with subsoil, the pits would be allowed to settle before applying the topsoil and performing final grading. Compaction ***could*** be used to further reduce potential settling of reclaimed drilling mud pits. Steep slope sites and access routes would be reclaimed using a dozer, track hoe, or similar equipment to minimize the surface disturbance.

Drill sites that would become part of a ***well field*** within 1 year of drilling would not be seeded until mine unit construction is complete. Those sites that would not become part of a mine unit within 1 year would be seeded after drilling mud pit reclamation is complete. In either case, seed would be planted during the next available seeding window, spring or fall.

2.3.2.2 Hydrologic Testing

Following completion of delineation drilling, detailed hydrologic testing would be conducted for each mine unit based on site-specific test plans. The purpose of the tests would be to collect and assemble detailed geologic and hydrologic information to define injection pattern areas, quantify hydrologic parameters (e.g., hydraulic conductivity, porosity, hydraulic communication patterns), develop hydrologic monitoring plans, and define baseline groundwater quality.

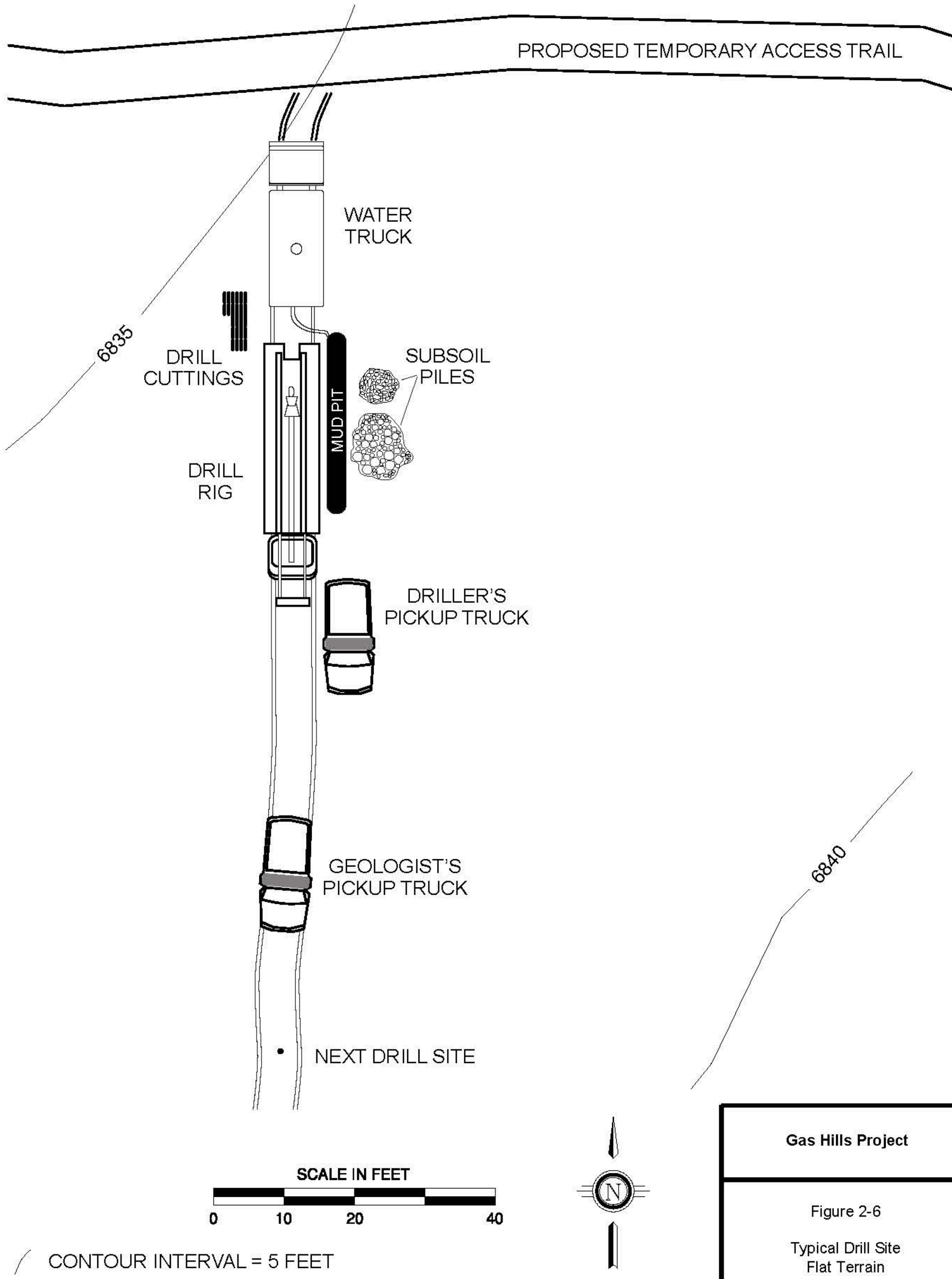


Source: PRI 2009, Figure 4.

Gas Hills Project

Figure 2-7

Typical Drill Site
Sloping Terrain



Source: PRI 2009, Figure 3.

Gas Hills Project

Figure 2-6

Typical Drill Site
Flat Terrain

As part of the hydrologic testing, monitoring wells would be installed within and around ***each*** mine unit (**Figure 2-4**). Once monitoring wells were installed, aquifer testing would be conducted. Results of the testing would be submitted to WDEQ-LQD prior to mine unit development Once monitoring wells were installed, aquifer testing would be conducted. Results of the testing would be submitted to WDEQ-LQD prior to mine unit development. Monitoring wells also would be installed within ***well fields of*** the mine unit and used to monitor the mine unit throughout operation and restoration of the unit (see **Appendix *B*, Figure *B*-1** for a typical ***well field*** pattern installation). The combination of perimeter ***mine unit*** monitoring wells and internal ***well field*** monitoring wells would allow for the collection of data to assess the uranium extraction activities and as an early indicator of potential excursions. ***Tests would be conducted under a General Permit for Temporary Discharges Involving Groundwater Well Pump Testing and Development under WDEQ-WQD WYPDES program.***

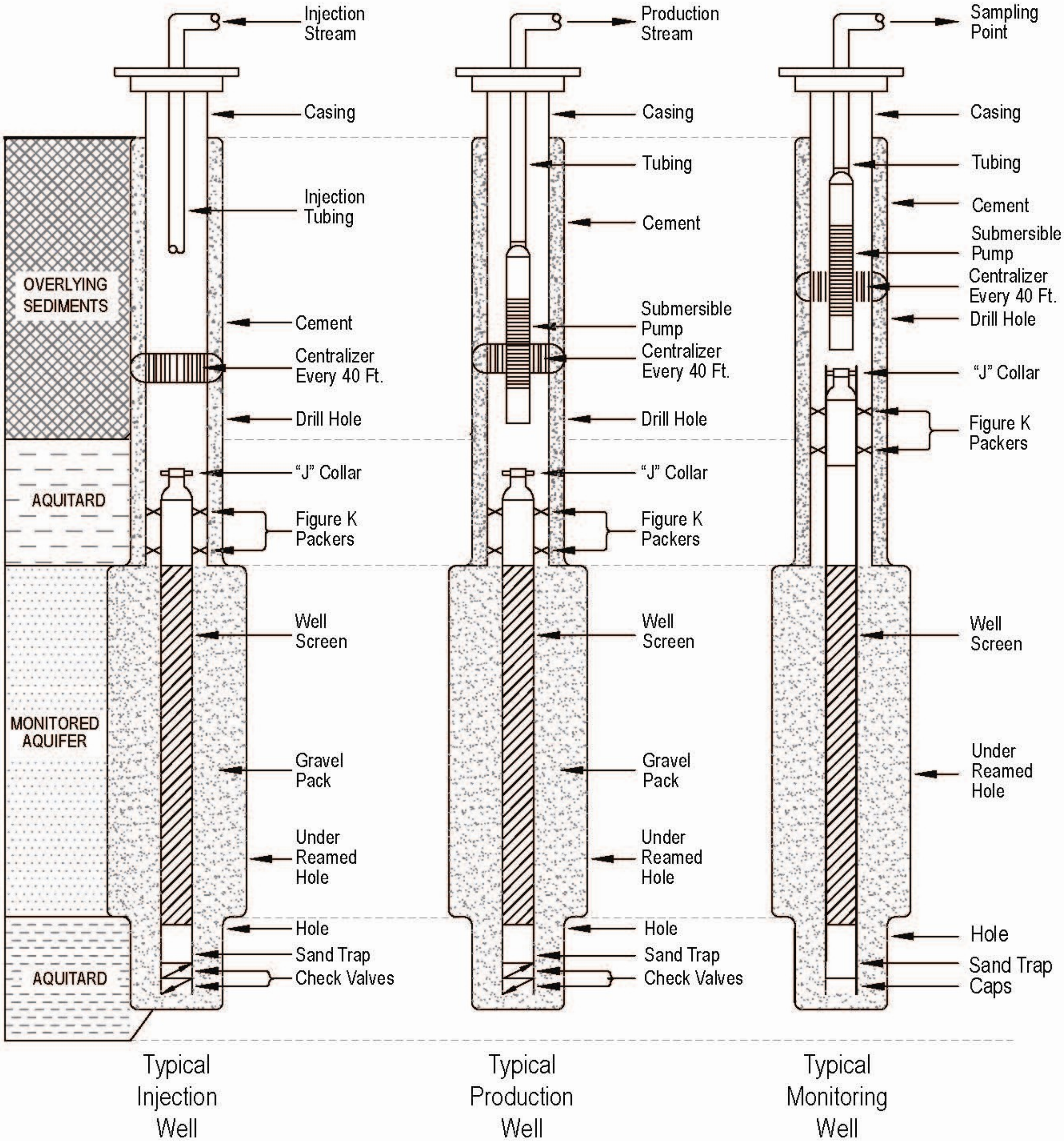
Surface disturbance caused by installation and completion of wells is described in the next section. Perimeter monitoring well disturbance would be similar to that caused by other types of wells but would include a 2-track access road to provide access to each well *of* the well ring surrounding each mine unit for short-term installation activities and long-term routine sampling. Perimeter monitoring well location and spacing would be determined using technically sound methods which could include, but not be limited to: hydrologic modeling; delineation drilling data; gradient consideration; dispersivity of recovery fluids; or the calculated operational flare and calculated excursion recoverability within 60 days. The density and spacing of perimeter monitoring wells would be determined for each mine unit during the detailed hydrologic testing***, hydrologic modeling, and delineation drilling data for*** **each mine unit.** ***However, for*** the purposes of this analysis, the BLM has assumed that perimeter monitoring wells would be located approximately 400 feet outside of each mine unit boundary, and would be located approximately every 400 feet along that perimeter (**Figure 2-4**). Additionally, to calculate the estimated surface disturbance for perimeter monitoring wells by mine unit, each well would be assumed to be constructed within an 18-foot disturbance, and operated within a 10-foot disturbance for 2-track roads along the perimeter (**Table 2-1**).

2.3.2.3 Well Construction

An ISR development includes 3 types of wells ***within each well field***; injection, production, and monitoring. **Appendix *B*, Figure *B*-1** illustrates a typical ***well field*** pattern installation. Topsoil from drill holes and drilling mud pits would be salvaged and placed in short-term stockpiles. Wells would be drilled and installed using truck-mounted rotary drilling rigs and water trucks. After an initial borehole is completed and the location determined to be viable for ISR, each well would be completed by expanding the hole to at least 3 inches larger than the outside diameter of the casing from the surface to near the top of the uranium ore zone. The hole would be cased with a polyvinyl chloride, fiberglass, or steel well casing that would extend from the top of the ore zone to approximately 2 feet above ground level.

The casing would be grouted in place with sealing material (e.g., cement slurry). The sealing material would be pumped down through the casing and up the space between the wall of the drilled hole and the casing (annulus) of the well. The well casing would be pressure sealed and secured in place, and the sealing material allowed to cure. All wells would be constructed in such a manner to maintain well integrity and ensure that the well annulus is sufficiently sealed to prevent communication from the production zone to overlying and underlying aquifers penetrated by the well. See **Figure 2-8** for a cross section of a typical completed injection, production, and monitoring well.

Wells and associated facilities would require fencing. Similar to delineation drilling, well construction would include the use of temporary drilling mud pits. These drilling mud pits would be enclosed using "hog panels" consisting of 4 feet high by 16 feet wide rigid wire grid fence panels wired to steel T-posts. The panels would completely surround each mud pit to exclude animals and people from the drilling mud pit.



Gas Hills Project

Figure 2-8

Typical Well Cross Section

Source: PRI 2009, Figures OP3-9, OP3-8, and OP3-10.

For the purposes of analysis in this EIS, surface disturbance as a result of well construction within the mine unit is captured within the total acreage of the mine unit, all of which is assumed to be disturbed during construction. See **Table 2-1** for these acreages as well as estimated acreage impacts from operations.

2.3.2.4 Access Roads, Header Houses, and Underground Utilities

Access roads within the mine units would provide access to the wells and supporting facilities inside each ***well field.*** Pipelines within the mine units would convey fluids between the wells and header houses and buried electrical lines within the mine units would provide necessary power to the facilities. The final location and number of ***well fields and associated*** header houses, access roads, and underground utilities within mine units would be determined based on results of delineation drilling and location of wells and support facilities.

Appendix *B*, Figure *B*-1 illustrates a typical ***well field*** pattern installation. Similar to wells, acreage impacts from the construction of access roads and underground utilities within mine unit boundaries are captured by the overall acreage of the mine unit (**Table 2-1**). All mine unit roads would be either light use 2-track roads with a 10-foot width and a speed limit of 10 mph or secondary roads with a 15-foot width and a 30 mph speed limit.

Fluids would be conveyed between the satellite facility and mine units through buried pipelines to small central fluid distribution buildings called header houses within each ***well field*** where oxidant would be added to the injection fluid. Each header house would support approximately 20 production wells and 40 injection wells. ISR fluids extracted from production wells would flow back through the header houses to the satellite facility for treatment through a second set of buried pipelines. For an average production rate of 1 million pounds per year, 7 to 8 ***well fields with*** header houses and associated wells would be installed during a year.

While the construction disturbance acreage of the header houses would be captured within the overall mine unit acreage, disturbance remaining during operations would be approximately 12 feet by 25 feet for each header house (**Table 2-1**).

2.3.2.5 Interim Reclamation

Interim surface reclamation would occur after ***well field*** construction, to stabilize the disturbed soils during operations. Disturbed surfaces not used during mine unit operation for roads, header houses, or aboveground power lines would be scarified and contoured, if necessary, followed by topsoil placement and seeding with an approved seed mix.

Areas that have been compacted would be scarified, ripped, and/or disked as necessary to relieve the compaction and prepare for topsoil placement. Where necessary, the surface would be graded and contoured to approximate original contours and to blend with the surrounding topography. Topsoil would be placed in a single lift to avoid compaction. On steep slopes, topsoil would be placed along the contour.

The BLM-approved seed mix would reestablish a vegetative cover consistent with the existing land use of livestock grazing and wildlife habitat. Seeding would be conducted during the first available seeding window or during spring or fall using a pitting and seeding method, appropriate for arid rangelands. Other seeding methods may be used in limited areas where the pitting and seeding method would change surface water flow. After interim reclamation, noxious weeds would be controlled as needed by annual spraying by a certified applicator using a registered herbicide, typically in late spring or early summer, or as advised by the herbicide's application instructions. Areas sprayed could include road cuts and fills, areas around buildings and fences, and isolated areas within recently constructed mine units.

The surface disturbance for wells generally would be reclaimed and seeded each year prior to disturbance associated with the following year's construction. Reclamation of longer term disturbance associated with header houses and access road would not occur until after cessation of mining activities. The majority of lands within the mine unit would have undergone interim reclamation prior to uranium production.

The uranium processing and mine unit facilities would be fenced to exclude sheep and cattle from damaging or otherwise interrupting production infrastructure and activities. Processing and mine unit fencing would be constructed according to BLM Handbook H-1741-1 and WDEQ-LQD Guideline 10 to restrict livestock but allow wildlife access, including large game. The evaporation ponds would be fenced to prevent both livestock and large game animals from accessing the ponds. Fencing also would be installed to protect vegetated areas following interim reclamation occurring outside of mine units. All reclaimed areas would remain fenced for a period of at least 2 years or until the vegetation is capable of renewing itself with properly managed grazing and without supplemental irrigation or fertilization. Fencing would be removed after reclamation standards, described in Section 2.3.6, Final Project Reclamation and Decommissioning, and Section 2.3.8, Existing Monitoring Plans, were met.

2.3.3 Mine Unit Operation

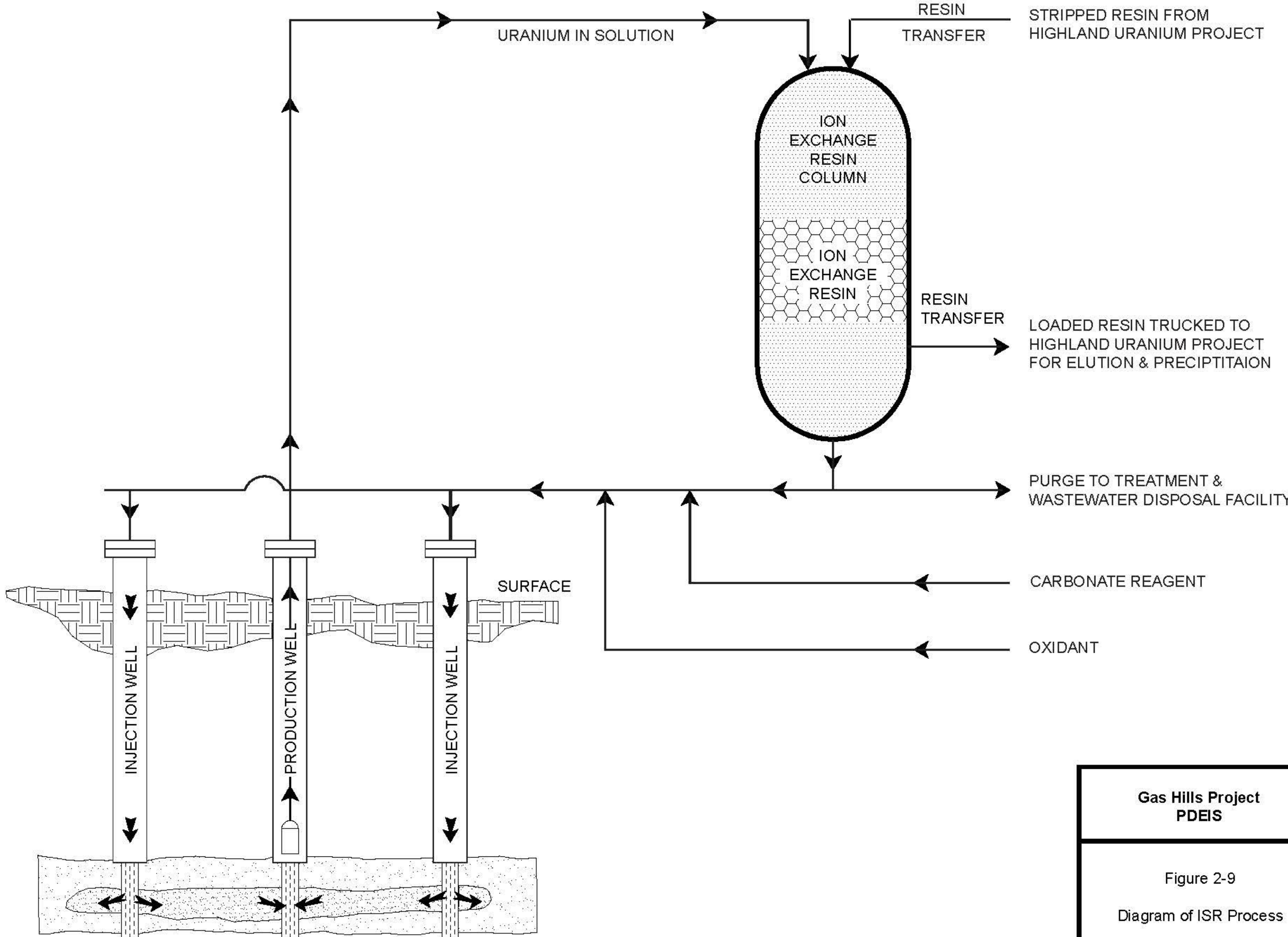
Mine unit operations would begin after construction of the first mine unit is completed or a portion of the mine unit sufficient to commence operation is completed. Once operations commence, they would continue on a 24 hour per day, 365 day per year basis until final closure. In addition to any BLM requirements, mine unit operations would be conducted under the jurisdiction of the WDEQ-LQD and the U.S. NRC.

2.3.3.1 In-situ Recovery

ISR involves the use of conventional water wells and a leaching solution, called a lixivant, to extract the economic mineral from the geologic formation in which it occurs without physically removing the ore-bearing formation. The lixiviant consists of: 1) native groundwater to which has been added an oxidant, such as oxygen or hydrogen peroxide, to make the uranium soluble in the groundwater; and 2) a complexing ion, such as carbon dioxide or sodium bicarbonate, to which the uranium combines allowing it to be carried in groundwater pumped from the subsurface.

The lixiviant would be injected into the uranium-bearing layer through a series of injection wells. The lixiviant causes the uranium to go into solution with the native groundwater. The uranium-bearing groundwater would be recovered by pumping from production wells located adjacent to the injection wells. The uranium laden groundwater would be conveyed through buried pipelines to a surface ion-exchange system at the satellite facility. The uranium in solution attaches to ion-exchange resin beads, removing it from the groundwater. After the uranium has been removed, the majority of the water would be recycled back to the injection wells where the uranium extraction process would continue. The ion-exchange resin loaded with uranium would be transported to Cameco's Smith-Ranch Highland processing plant for further processing into a stable uranium concentrate powder (yellowcake).

A schematic diagram of the ISR process is presented as **Figure 2-9**. After the economic recovery limit of a production zone has been reached, lixiviant injection would stop, and groundwater restoration of the production zone would start. Groundwater restoration involves returning the affected groundwater within the production zone to its pre-operational baseline water quality ***or an alternative concentration limit*** meeting the requirements of U.S. NRC and WDEQ-LQD rules and regulations, and is discussed in Section 2.3.5, Mine Unit Restoration and Reclamation, of this document.



Source: PRI 2009, Figure 2.

Gas Hills Project PDEIS

Figure 2-9

Diagram of ISR Process

A limited (approximately 1 percent) purge or "bleed" volume of water would be removed during the ISR process to maintain an inward groundwater flow within each mine unit. The result of this over-pumping would be creation of small cones of depression centered on production wells within the mine unit. These cones of depression would collectively prevent both injected chemicals and leached ore from migrating into the ***aquifer*** surrounding each mine unit. Bleed water would be disposed of as waste water as described in Section 2.3.1.2, Waste Management.

2.3.3.2 Monitoring and Reporting

Unintended spread of lixiviant beyond the boundaries of the mine unit within the groundwater is called an excursion. Excursions could occur horizontally within the uranium-bearing layer (lateral movement of lixiviant away from the production zone), or vertically (lixiviant crossing less permeable confining strata and migrating into aquifers above or below the producing zone).

U.S. NRC licenses and WDEQ***-LQD*** permits require periodic testing of water from monitoring wells for early identification of excursions. Monitoring wells ***for each mine unit*** would be located horizontally outside of the mine unit and within the production zone, and vertically above and below the production zone in adjacent aquifers, based on a design approved by ***WDEQ-LQD****.* Water samples would be collected from monitoring wells at least every 2 weeks during operation to test for excursions of lixiviant-bearing solutions. In addition, mechanical integrity testing would be performed before a production well is brought on-line and every 5 years during operation, to verify the well casing has no leaks. Should leaks or excursions be identified and confirmed, Cameco would be required to correct the excursion using methods approved by U.S. NRC and WDEQ. Corrective actions could include adjusting the rate of injection and pumping of lixiviant-bearing solutions, establishment of capture wells to limit any movement of the excursion, and cessation of ISR activities in the mine unit. Selection and approval of corrective actions to manage excursions would be within the jurisdiction of the U.S. NRC and ***WDEQ-LQD,*** rather than the BLM.

2.3.3.3 Transportation

Primary access to the GHPA would be either via State Highway 136 from Riverton or by Fremont County Road 212 from Waltman. Ion-exchange resin loaded with uranium would be transported to Cameco's Smith-Ranch Highland processing plant for stripping and processing into yellowcake. The stripped resin would be transported back to the GHPA for reuse. Transportation of resin (including container and vehicle specifications) would be conducted under the jurisdiction of U.S. NRC and the USDOT. Cameco estimates that, during the period of uranium recovery operations, 1 truck would make the roundtrip once per day with approximately 500 cubic feet of resin. The interstate highway, U.S. highways, and state highways are maintained year round***; maintenance (plowing in winter) on public roads is prioritized by the WYDOT based on use*****.**

Up to 20 deliveries of materials supporting the Project (e.g., sodium bicarbonate, carbon dioxide ***[CO_2]***, oxygen, hydrochloric acid, or propane) would occur per week during operations. Commercial delivery services would provide general shipping services an estimated 3 times per week. In addition, traffic would include up to an estimated ***24*** heavy trucks per day and 54 light trucks per day, generally for employees and construction workers.

County and private roads could be impassable or closed during inclement weather. On-site storage capacity for raw materials and product would be constructed to cover 7 consecutive days of road closures. Should roads remain impassable for that period or longer, Cameco would contract with road maintenance crews to provide passage.

2.3.4 Personnel/Workforce

The Project would employ a mix of full-time personnel and contractors throughout the life of the mine. Approximately 20 full time employees and 20 contractors would be hired in the first year of the Project.

Contractor personnel would include employees of companies conducting work at the site (typically drilling and construction) under contract to Cameco, and would remain at the same level through year 20. The Project would employ approximately 65 full-time workers from year 2 through year 19, tapering down to 50 in years 20 and 21, and 40 full-time personnel through the final year of the Project. It is likely that a majority of the workers would live in Riverton or Casper. The Project would contribute to public revenues through payment of taxes to federal, state, and local governments, including income taxes, mineral severance taxes, property taxes, and sales taxes.

2.3.5 Mine Unit Restoration and Reclamation

Final reclamation of mine units generally consists of 2 major activities:

- Groundwater restoration; and
- Final mine unit surface reclamation.

Mine unit groundwater restoration and surface reclamation would occur while construction or operations occur in other mine units. Once the economic recovery limit of any mine unit has been reached, uranium recovery operations would cease, and groundwater restoration would commence. After groundwater within a mine unit has been restored to pre-operational baseline water quality or an alternative concentration limit approved by the U.S. NRC ***and WDEQ-LQD,*** removal of mine unit infrastructure and final surface reclamation would be implemented. Groundwater restoration would be approved under the jurisdiction of WDEQ-LQD and the U.S. NRC while surface reclamation would be conducted under the jurisdiction of WDEQ-LQD, U.S. NRC, and the BLM. Activities at each mine unit, from construction through operation and the end of final surface reclamation, is estimated to take 10 to 13 years, based on currently estimated initial and maximum production rates and on the anticipated time frame for groundwater restoration. Production rates would be adjusted in response to actual mine unit well flows, uranium recovery rates, the market demand for uranium, and the actual rate of groundwater restoration. These adjustments potentially would affect the estimated time to final surface reclamation. ***Additionally, as part of final reclamation, surface areas affected by lixivient spills would be surveyed for radiological contamination. If radiological levels are sufficiently high, the soils would be disposed of offsite at a NRC-or NRC-agreement State-licensed facility.***

2.3.5.1 Groundwater Restoration

Restoration of groundwater to pre-mining quality would be a sequenced, phased process using Best Practicable Technology (BPT). The goal of groundwater restoration would be to return the affected groundwater within the production zone to pre-operational baseline water quality ***or to alternative concentrations approved by WDEQ-LQD and U.S. NRC.*** For affected groundwater outside the production zone, an evaluation would be performed on a well-by-well basis. Additionally, water outside the aquifer exemption boundary must be protected to applicable USEPA maximum contaminant levels per 40 CFR 141, as amended July 1, 2001***, and*** *W*DEQ***-LQD*** Rules and Regulations Chapter 11, Section 5(a)(ii)(B) through (D).

Groundwater restoration would use the existing mine infrastructure and would not require additional construction. Production wells would be switched to groundwater restoration, and water flow would be conveyed through existing piping and header houses. Groundwater restoration would be accomplished using several methods such as groundwater sweep, reinjection of groundwater treated by RO, bioremediation, or addition of reducing chemicals. Groundwater restoration is currently estimated to take 4.5 to 7.5 years to achieve within a given mine unit; however, restoration activities would continue until stability is achieved and regulatory concurrence has been granted by WDEQ-LQD and U.S. NRC.

<u>Methodology</u>

At the beginning of groundwater restoration, the wells sampled for baseline water quality would be resampled and analyzed to characterize an "end of mining" water quality average. The ***collected***

samples would be analyzed for ***a minimum of*** TDS, cations (***e.g.,*** calcium, magnesium, sodium, potassium, ***ammonia),*** anions ***(e.g.,*** bicarbonate, chloride***), and radiation levels (e.g., gross alpha emitters, gross beta emitters, radium). During periods of active restoration, wells would be sampled annually and analyzed for the same parameters.*** To track the progress of restoration, the ***same*** wells also would be sampled monthly and analyzed for conductivity, chloride, and uranium.

A combination of the following groundwater restoration tools may be necessary to return the quality of water to pre-operational baseline conditions utilizing BPT, including the following.

1. ***Groundwater Treatment and Reinjection to Reduce TDS: Groundwater pumped from the well field would be treated using RO to remove ions. The filtered water would be reinjected into the well field. Approximately 5 to 20 percent more water would pumped from the well fields than would be injected, which would draw the affected groundwater plume towards the production wells. The RO capacity would be sized to meet the water needs for the restoration process. Circulation of cleaned water would reduce TDS in the groundwater. This would be the primary tool used during groundwater restoration. Groundwater sweep, as described below, may be used to augment the groundwater treatment and reinjection process for limited periods of time in selected locations*****.**

    a. **Groundwater Sweep:** Water would be pumped from the well field to the processing plant through all production and injection wells without reinjection. Uncontaminated native groundwater flows into the ore body, thereby flushing the contaminants from areas that have been affected by the uranium recovery process. Groundwater produced during the sweep phase would initially contain uranium and other contaminants mobilized during the uranium recovery phase, but would decline gradually with time. Groundwater produced during the sweep phase would be treated using RO technology with the treated water being recycled and used as lixivant in the remaining mine units, and the brine being disposed of by evaporation or deep well-disposal by injection.

2. **Biological Reductant and/or Chemical Reductant Treatment:** Biological nutrients (e.g., molasses or ethanol) or a chemical reductant (e.g., sodium sulfide) would be added to water being pumped through the formation to create a reducing environment, so the remaining dissolved uranium would precipitate out of solution.

3. **Chemical Treatment for pH (if required):** Final adjustment of pH may be required to assist in immobilizing certain ions, particularly metals. Adjustment of pH would be achieved by adding chemicals such as potassium hydroxide or sodium hydroxide into the uranium production zone during the later stages of groundwater restoration to return the aquifer to the original pH.

During operations and groundwater restoration, the wastewater treatment would take place at the Carol Shop or the second satellite facility.

The proposed groundwater restoration methodology is based on current, industry-wide practices and innovations. As groundwater restoration technology continues to evolve, alternative restoration methods that could accelerate and/or improve groundwater restoration success would be considered and evaluated. Regulatory approval from WDEQ-LQD would be obtained prior to initiating any alternative restoration method.

<u>Stability Monitoring after Groundwater Restoration</u>

Following concurrence that groundwater restoration has been achieved in a particular mine unit by WDEQ-LQD, groundwater quality would be monitored for an additional 12-month period to ensure that the restored groundwater quality remains stable. Stability monitoring would involve collection of samples from all monitoring wells at the beginning of the stability period, collection of samples from monitoring wells within the production zone once every 2 months, and collection of samples from perimeter monitoring wells on a monthly basis.

At the end of the stability period, monitoring data would be evaluated to determine the success of the groundwater restoration effort. Cameco would provide a restoration report to WDEQ-LQD and U.S. NRC containing the data evaluation and an analysis of the restoration effort. The agencies would review the reports and determine whether restoration was successful, whether more stability sampling would be required, or whether additional active restoration would be required.

2.3.5.2 Final Mine Unit Surface Reclamation

Once Cameco has restored the groundwater within a mine unit to target water quality approved by the U.S. NRC and WDEQ-LQD, final surface reclamation would be implemented. ***A final radiological survey would take place, and wells*** would be plugged and abandoned, followed by the removal of subsurface infrastructure (i.e., buried pipelines, power lines, and other utilities) and surface facilities (i.e., aboveground power lines, header houses, and roads) and minor site grading. This activity would involve re-disturbing the entire mine unit surface. Removal of infrastructure would then be followed by final surface reclamation and revegetation operations. Reclamation of mining-related surface disturbances in any mine unit would be implemented, and should be trending towards reclamation success within 2 years following approval by the WDEQ-LQD and U.S. NRC of groundwater restoration in that mine unit.

All wells would be abandoned in accordance with WDEQ-LQD Rules and Regulations. Wells would be sealed from bottom to top with an approved abandonment fluid (e.g., cement slurry). The soil around the well casing would be excavated to at least 2 feet below ground surface ***(bgs)***, the casing would be cut off, and a concrete plug would be placed on top of the casing. The excavated area around the abandoned well would be backfilled with the excavated material to the original surface and seeded with the approved seed mix.

2.3.6 Final Project Reclamation and Decommissioning

Following completion of mining and groundwater restoration activities at all mine units Cameco would decommission and reclaim all facilities and other mining-related disturbance outside of the mine unit boundaries. The goal of this activity would be to return those surface areas affected by ISR activities to a condition which would support the pre-mining land use of livestock grazing and wildlife habitat. Reclamation activities (i.e., ***final radiological survey,*** decommissioning, grading, topsoil application, and seeding) for all mining-related surface disturbances would be completed within 2 years following approval of final groundwater restoration within the GHPA. Final reclamation would be deemed complete and successful based upon criteria detailed in Section 2.3.9, Applicant-committed Environmental Protection Measures and in reclamation standards outlined in the Lander ***Proposed*** RMP ***and Final EIS*** (BLM ***2013***). All reclaimed areas would remain fenced for a period of at least 2 years, or until the vegetation is capable of renewing itself with properly managed grazing and without supplemental irrigation or fertilization. The fencing would not be removed until the BLM and WDEQ-LQD agree that the revegetated areas are ready for livestock grazing.

Those facilities requiring decommissioning and removal following the completion of groundwater restoration of the entire Project include, but are not limited to:

1. Buildings and structures, including the Carol Shop facility and the additional satellite facility (if constructed);
2. Process and water treatment facilities housed within these structures including tanks, piping (aboveground), pumps, and related equipment;
3. Buried piping including piping between mine units and process and water treatment facilities, and piping between the Carol Shop facility or the additional satellite facility and the evaporation ponds or wastewater disposal well(s);
4. Evaporation ponds and/or wastewater disposal well(s);

5. Overhead and buried power lines; and
6. Access roads.

Prior to final reclamation, all radiologically contaminated portions of buildings, process vessels, and other structures and affected areas would be decontaminated to U.S. NRC unrestricted release standards or, if decontamination is not possible, removed to a disposal facility licensed by the U.S. NRC to receive such material. Radiological surveys would be conducted following radiological decontamination to verify that areas affected by the Project meet U.S. NRC decommissioning criteria. Note that there are areas that currently have elevated radiological levels, namely the previously mined areas and their associated access roads.

Prior to demolition of buildings and structures within the GHPA (including the Carol Shop facility, satellite facilities, and pump stations), all equipment would be removed. Any contaminated materials would be decontaminated or removed for disposal at an U.S. NRC- ***or NRC-agreement State-***licensed facility. Buildings and structures would be dismantled and removed from the GHPA either for disposal at an appropriately licensed solid waste facility or for salvage.

All buried piping would be removed from the GHPA. Contaminated materials would be disposed at a ***U.S.*** NRC- ***or NRC-agreement State-l***icensed facility. Non-contaminated material would be disposed at an appropriately licensed facility and/or would be removed for salvage. Removal of piping would re-disturb pipeline ROWs which then would be reclaimed and seeded.

Upon completion of use, and evaporation of excess liquid, solid wastes contained in the evaporation ponds, as well as the primary liner, would be removed and disposed of at an U.S. NRC- ***or NRC-agreement State-***licensed disposal facility as described in Section 2.3.1.2, Waste Management. The underlying leak detection system and secondary liner would be surveyed and tested for contamination. Any portion of the leak detection system, secondary liner, and/or underlying materials that did not meet U.S. NRC decommissioning criteria would be excavated and removed for disposal at a NRC- ***or NRC-agreement State-***licensed facility.

Portions of the leak detection system which met U.S. NRC decommissioning criteria would be covered with a minimum of 4 feet of overburden and topsoil and reclaimed in place. Any uncontaminated solid waste material which could be detrimental to site reclamation would be removed and disposed of at an appropriately licensed facility. Following cleanup of the site and removal of contaminated materials, the evaporation ponds would be graded to their approximate original contour. Grading would include the replacement of material excavated during the construction of the evaporation ponds. Topsoil would then be replaced and the area reclaimed to the final reclamation standards presented in the applicant-committed environmental protection measures.

All buried and overhead power lines would be removed from within the GHPA. Removal of buried lines and power poles would re-disturb power line ROWs, which then would be reclaimed and seeded.

Prior to reclamation, all roads would be surveyed for radiological contamination in excess of radiological levels documented as pre-existing baseline conditions. ***If surveys detect materials that exhibit radiological levels above pre-mining background baseline levels, those areas*** would be cleaned ***up according*** to appropriate U.S. NRC standards and the ***above-baseline level materials would be removed and*** disposed of at an U.S. NRC- ***or NRC-agreement State-***licensed facility. Following decontamination, roads would be ripped and/or disked to relieve compaction. Excess imported gravel would be removed. Culverts would be removed and pre-mine drainages reestablished. All roads and ditches to be reclaimed would be graded and contoured to blend with the surrounding terrain.

Those portions of roads utilized for access to the site, facilities, and mine units, including the AML ***R***oad, the Carol Shop Road, and constructed access roads, would be reclaimed unless landowners and lessees request that the roads be left for future access and accept the responsibility for their long-term maintenance and ultimate reclamation.

2.3.7 Temporary Closures

U.S. NRC regulations allow for the placement of uranium ISR facilities on standby for up to a 24-month period ***(10 CFR 40.42)***. If operations have not resumed by the end of the 24-month period, Cameco would be required to proceed with Project decommissioning unless a request for a time extension was submitted to and approved by the U.S. NRC. Temporary closures during the operational life of the Project, while not expected, could occur under specific economic conditions. This section discusses the sequence of activities that would take place in the event of a temporary closure.

An economic downturn in the uranium market that would render the Project unprofitable would cause a temporary cessation of uranium production. In addition, if Cameco were to decide to end the Project early, activities at the mine could not stop immediately. The following actions would take place:

- Delineation drilling would cease and surface disturbances would be reclaimed in accordance with the applicant-committed environmental protection measures in Section 2.3.9, Applicant-committed Environmental Protection Measures;
- Mine unit development and construction would cease;
- Producing mine units would continue in the production mode until the uranium resource was depleted, at which time they would proceed into the groundwater restoration phase;
- Mine units in groundwater restoration would continue in that mode until regulatory requirements for restoration was achieved; and
- Once groundwater restoration was completed and approved, surface reclamation and decommissioning would be completed on a mine unit by-mine unit basis until all mine units were decommissioned.

Once these activities were completed, Cameco would make a business decision as to whether to proceed to final reclamation or to keep the main injection/recovery trunk lines and uranium recovery facilities in place in anticipation of a future production restart. A decision to keep these facilities in place for an extended care and maintenance period would result in the following actions by Cameco:

- Main trunk lines to the uranium recovery facility would be drained and the excess water would be treated and disposed of.
- Open ends of the pipelines would be sealed, and manholes would be secured from access by securing the lids to the manholes and locking the access hatches.
- Plant equipment, including reagent tanks, would be drained, decontaminated, and protected for future use.
- Interior building surfaces would be decontaminated and cleaned.
- Solids would be removed from the evaporation ponds and properly disposed, and the pond liner surfaces would be decontaminated and cleaned.
- Fuel storage tanks would be removed from the site and the storage areas would be reclaimed.
- Buildings and ponds would be secured from public and animal access using fences and by securely locking access doors.
- Facilities would be inspected on a monthly basis. The inspected areas would include restricted access to radiological areas, evaporation ponds, mine units, and perimeter fences.
- Any discovered breach of site infrastructure would be reported to the proper regulatory and law enforcement authorities by Cameco. Potential hazards resulting from the breach would be

assessed, documented, and reported as required. The breached area would be re-secured as necessary.

- A remote alarm and monitoring system would be considered if the technology was determined practicable at such a remote location.

2.3.8 Existing Monitoring Plans

A monitoring program has been developed by Cameco and approved by WDEQ-LQD and U.S. NRC to monitor the effects of the Project. The objectives of the monitoring program would be to: 1) demonstrate compliance with the monitoring plan and ensure compliance with other state and federal regulations and laws; 2) provide early detection of potential problems; and 3) supply information that would assist in directing corrective actions should they become necessary.

The Project surface ***water*** and groundwater monitoring programs for pre-operational, operational, and post-operational monitoring are detailed in the Operations Plan (PRI 2009). A detailed surface ***water*** and groundwater sampling and analysis plan also is part of the LQD requirements. The following sections summarize the major elements of these monitoring plans.

Surface ***Water*** and Groundwater Monitoring

The predominant natural surface water flowing through the permitted area is West Canyon Creek (WCC), which is considered to be a perennial stream. Although the spring flows year round, only about 1.7 miles of the Creek flows on a perennial basis. With the exception of WCC, most drainages throughout the property are intermittent and ephemeral in nature, and flow only in response to spring run-off or occasional thunderstorms.

Baseline surface water conditions would be characterized based on samples collected from 6 surface water locations prior to construction of mine facilities: WCC-1, WCC-2, WCC-3***, or*** WCC; Cameron Spring; and 2 locations in Fraser Draw denoted as WFD and EF***D***. Results from these locations would be used to compare results from monitoring during the life of the Project.

Three surface water sites and 1 groundwater site would be routinely monitored during the life of the Project as part of the area-wide monitoring program. These sites would include the following:

- Cameron Spring Reservoir which is located south and upgradient of the proposed Mine Unit 1 in the SESE Qtr/Qtr of Section 2, T32N, R90W. Monitoring would include discharge rate and water quality from the spring;
- Stock Pond in Section 32, a small constructed pond near the northern end of proposed Mine Unit 1, in the SWNE Qtr/Qtr of Section 32, T33N, R89W. Monitoring would include quarterly grab samples that would be analyzed for conductivity, pH, natural uranium, and radium-226;
- WCC which flows through proposed Mine Unit 4 has 2 established surface water monitoring stations. Monitoring would include quarterly grab samples at the start of Mine Unit 4 construction; and
- The current ***industrial*** water supply well ***and any new wells drilled by Cameco*** for the Carol Shop facility would be ***monitored following*** the requirements of the ***appropriate state and federal agencies*.**

Additional monitoring wells would be installed as part of mine unit development and would include perimeter wells that surround and monitor the mine unit as well as wells to monitor overlying and underlying aquifers. A network of regional groundwater monitoring wells already exists at the GHPA that was previously sampled and measured to establish pre-mining baseline groundwater quality and limited static groundwater elevations.

Post-operational Vegetation Monitoring

Project monitoring also would include post-operational vegetation monitoring. The reclamation goal within the GHPA would be to return the land to a condition that would sustain the pre-mining land use of livestock grazing and wildlife habitat. The success of revegetation in meeting the land use goal would be assessed prior to application for bond release by using the Comparison Area (COMA) method as described in State of Wyoming regulations. A COMA is defined as a land unit which is representative, in terms of physiography, soils, vegetation, and land use history, of a plant community where the pre-mining total vegetation cover and species diversity has not been collected, or where the area to be affected is small and incidental to the operation. The representative nature of each COMA is validated by a subjective field reconnaissance of the site or by subjective evaluation of the vegetation data generated by a sampling program. Post-mining quantitative data from the COMAs would be directly compared, by standard statistical procedures, to data from a reclaimed vegetation type when evaluating revegetation success for full bond release.

Revegetation would be considered successful when, at the end of the bonding period, the following have been demonstrated:

- Vegetation species of the reclaimed land are self-renewing under natural conditions prevailing at the site;
- Total vegetation cover of perennial species (excluding noxious weed species) and any species in the approved seed mix is at least equal to the total vegetation cover of perennial species (excluding noxious weed species) on the area before mining;
- Species composition and diversity are suitable for the approved post-mining land use; and
- The above criteria are achieved during 1 growing season, based on observations collected no sooner than the fifth full growing season following reclamation.

Further details of vegetative success criteria are listed in Section 2.3.9, Applicant-committed Environmental Protection Measures.

Air Monitoring

Cameco would maintain a continuous air monitoring program at locations upwind and downwind relative to the permit boundary in order to ensure compliance with U.S. NRC regulations 10 CFR 20.1301, 20.1302, and 20.1501. The air monitoring program would include passive gamma and radon monitoring devices. Air particulate air sampling also would be conducted.

Wildlife Monitoring

Wildlife also would be included as a component of monitoring at the mine. Wildlife surveys were conducted in 1992, 1993, 1994, 1996, 1997, 1999, and 2007 and provide baseline information. These annual wildlife surveys were reinitiated by Cameco in 2009, 2010, and 2011, and reports were provided to the WDEQ and the BLM.

A Wildlife Monitoring Plan was prepared in consultation with and approved by the BLM, the lead agency for Project-related wildlife issues, as well as the WGFD and the USFWS. The plan describes the methodology and frequency of annual monitoring as well as listing the specific species to be monitored. The plan would be reviewed annually with the BLM to address any necessary changes. The most recent update was submitted for BLM approval *in* ***August 2013, and is included as Appendix C*****.**

Annual surveys that are part of the revised monitoring plan include: occupied greater sage-grouse leks within 2 miles of the GHPA, active raptor nests within 1 mile of the GHPA, mountain plover presence/absence surveys in known habitat within 0.25 mile of the GHPA, and surveys for burrowing owl occurrence and sign. Opportunistic sightings of other wildlife species also would be included in annual reporting. After construction of the evaporation ponds, Cameco would monitor potential waterfowl activities in and around the ponds and would be required to report any migratory bird losses.

2.3.9 Applicant-committed Environmental Protection Measures

Applicant-committed environmental protection measures included in Cameco's PoO (PRI 2011a) or Mine Permit Application (PRI 2009) that would avoid, minimize, or mitigate impacts due to the Proposed Action and Alternatives are provided in the following sections.

2.3.9.1 Air Quality

Construction

- ***All areas disturbed for mine unit well, pipeline, and utility trenches would be reclaimed and revegetated as soon as possible after construction was completed.***

Construction/Operation

- ***Site speed limits of 40 mph on primary roads, 30 mph on secondary roads, and 10 mph on 2 track roads would be implemented to reduce wildlife/vehicle collisions and generation of dust.***
- ***Watering for dust control will be used as necessary, and water shall be from an approved and permitted source.***

2.3.9.2 Cultural Resources

Construction

- ***Cameco has a standard policy that if any cultural resources, fossils, or remains are found during the excavation process that work would immediately cease at that location and the proper personnel would be notified. This language will be added to a Standard Operating Procedure for inclusion. If the findings are determined to be significant, mitigation methods would be commenced.***

2.3.9.3 Geology

Construction

- ***Cameco has no plans to implement any major construction on slopes greater than 25 percent; however, well installation could occur in areas where there are slopes at this grade. The hazard from landslides would be reduced by avoiding construction on steep slopes and existing landslides, or by stabilizing the slopes. Stability increases when groundwater is prevented from rising in the landslide mass by: 1) covering the landslide with an impermeable membrane, 2) directing surface water away from the landslide, 3) draining groundwater away from the landslide, and 4) minimizing surface irrigation. Slope stability also increased when a retaining structure and/ or the weight of a soil/rock berm are placed at the toe of the landslide or when mass is removed from the top of the slope. A Standard Operating Procedure will be adopted to meet this requirement.***

2.3.9.4 Livestock Grazing

General Construction

- ***Both primary and secondary access roads would use culvert crossings at drainages.***

Operation

- ***Fences surrounding evaporation ponds would be constructed in compliance with U.S. NRC regulations and BLM Handbook H 1741-1 standards to prevent both livestock and wildlife from accessing the ponds.***

- ***Long-term fencing would be constructed around the mine unit production facilities and processing satellites that would prevent access by sheep and cattle but still would allow wildlife access to forage (Section 2.3.2.5, Interim Reclamation).***

2.3.9.5 Paleontological Resources

Construction

- ***If suspected fossil materials were uncovered during construction or mud pit excavation, work would stop immediately and the findings would be evaluated by an onsite geologist to determine their significance. If the findings were determined to be significant, additional mitigation measures would be undertaken. Mitigation could include consultation with a certified paleontologist, additional field surveys and possible salvage of any paleontological resources. A standard operating procedure would be put into place to cover the specific handling and requirements of paleontological resources.***
- ***In areas that have not been identified in the Paleontological Resource Survey, Cameco staff would be advised to spot check excavated material for bedrock disturbance.***

2.3.9.6 Public Health and Safety

Operation

- ***Mine unit fluid spills that could contaminate surface soils would be minimized through the use of proper construction and operational procedures, detection devices and alarms, and proper training of personnel.***
- ***During final reclamation buildings, structures, well, pump stations, overhead and buried power lines, evaporation ponds, and buried piping would be removed.***
- ***If deep disposal wells meet all regulatory requirements and are determined to be technically feasible, disposal wells would be completed and equipped at 2 of the 3 test well locations to receive wastewater for disposal.***

Decommissioning

- ***Buildings and structures would be dismantled and removed from the Project and would be salvaged or disposed of at an appropriately licensed solid waste facility.***
- ***Radiological surveys would be conducted following any radiological decontamination to verify that areas affected by the Project meet U.S. NRC decommissioning criteria.***

2.3.9.7 Soils

Construction

- ***Topsoil would be placed in a single lift to avoid compaction. On slopes of 4:1 (horizontal to vertical) or steeper, topsoil would be placed along the contour. Topsoil would not be placed under excessive wet, dry, or frozen ground conditions, which would cause excessive clod or frost chunks to form. Topsoil thicknesses would reflect the approximate thicknesses of topsoil originally available at the locality being reclaimed. All salvaged topsoil would be utilized for reclamation purposes.***
- ***Topsoil information would be provided to WDEQ-LQD, together with proposed stripping depths, as part of the Hydrological Test Proposal for each mine unit. In those cases where topsoil stripping would be necessary, such as a major road or building site, site-specific topsoil thickness and suitability evaluations would be performed utilizing either drill borings or backhoe excavations. Topsoil stripping depths would be based on visual observation and the results of chemical analyses, and would be field staked prior to salvage operations. Topsoil depth and suitability determinations would be made by***

persons qualified by education and/or training to make such determinations. The maximum stripping depth would be 12 inches for all excavations, except for mud pits and evaporation pond sites, which would have all suitable material salvaged and stockpiled.

- ***Typical long-term topsoil stockpiles would be large, contain topsoil for more than 1 year and result from the excavation of building sites, evaporation ponds, culvert crossings, and primary and secondary access roads. These stockpiles would be constructed with 3:1 or flatter side slopes and would be seeded on the contour as soon as possible after construction using only the grass species of the BLM and WDEQ-LQD approved permanent seed mix. All long-term stockpiles would be bermed along the bottom to control sediment runoff and would be identified with highly visible signs containing the word "TOPSOIL" in letters at least 6 inches high. The signs would be placed on stockpile approach roads not more than 150 feet from the stockpile. Locations of long-term stockpiles and their volumes would be included in each WDEQ-LQD Annual Report.***
  - ***The need to conduct nutrient analyses of topsoil that has been stockpiled for more than 1 year would be assessed prior to redistribution of the topsoil. The size and depth of the stockpile, the amount of vegetation growth present, and the length of time the topsoil was stored would be taken into consideration. Nutrient analyses would not be performed on stockpiles that were less than 5 feet thick as the microbial activity within the soil would be maintained because of the limited thickness and resultant compaction. If after two growing seasons following topsoil application and seeding, revegetation problems are identified, nutrient analyses would be performed. Should the analyses indicate a nutrient deficiency, the area would be fertilized and reseeded.***
- ***Typical short-term topsoil stockpiles result from excavation of drill hole and well mud pits. Typically, topsoil would remain in short-term stockpiles for no more than 6 months. This would allow for direct replacement of "live topsoil" on the disturbed surface. Except for small short-term stockpiles, which would be constructed with gentle side slopes, the perimeter of long-term topsoil stockpiles would be bermed to control sediment runoff. Additionally, large topsoil stockpiles, such as those that would result from the excavation of large building sites and the evaporation ponds, would be constructed with 3:1 or flatter side slopes and would be seeded on the contour.***

<u>Mine Unit Construction</u>

- ***Topsoil would be separately stockpiled within the mine unit disturbance area and replaced after well construction completion.***
- ***Pre-construction contours would be restored and reclaimed after a well was constructed.***
- ***All areas disturbed for mine unit well, pipeline, and utility trenches would be reclaimed and revegetated as soon as possible after construction was completed.***
- ***Cameco would mark the entrance to well fields with signs advising traffic to stay on established 2-tract access routes. In addition, Cameco employees would be trained to follow the mine site transportation policy of "one way in, one way out" to minimize disturbance.***

<u>Storm Water Management</u>

- ***All long-term topsoil stockpiles (e.g., soil removed from building areas, access roads, etc.) would be fully contained and vegetated. A containment ditch and berm would be constructed at the base of each stockpile to prevent any loss of topsoil before new vegetation could be established.***
- ***All available disturbed areas, including topsoil piles, road cuts, etc. would be seeded with the approved seed mix at the first appropriate season, spring or fall, to control erosion***

and protect the topsoil resource. Should weather or other conditions prohibit disturbed areas from being seeded for more than 3 months, the area would be scarified with a disc, chisel plow, or similar apparatus, or mulched with a straw mulch crimped at a rate of 2 tons per acre, to assist in conserving the topsoil resource until seeding can be accomplished. The establishment of a temporary cover crop, such as barley, winter wheat, millet, or rye seeded at 30 pounds per acre also could be utilized to assist in protecting the topsoil resource.

- ***Areas with slopes greater than 25 percent would be mulched with straw mulch crimped at a rate of 2 tons per acre or planted with a temporary cover crop as soon as possible to assist in preventing erosion. Geotextile "mulched matting" and select erosion control products would be utilized on areas where erosion control and vegetation establishment is particularly difficult. BMPs would be utilized to control sediment loss from stripped and or recently topsoiled and seeded areas.***
- ***For exposed soil areas where construction activities were temporarily ceased for a period of 28 days or more, temporary stabilization measures would be implemented. These measures could include surface roughening, cover crop plantings, mulching or erosion control blankets. Temporary erosion protection would be especially important for areas containing graded slopes, ditches, berms, and soil stockpiles. The primary method of revegetation would be the pitting and seeding method. To the extent possible, crossing perennial and intermittent drainages with drill equipment and vehicles would be avoided. If it became necessary to cross a drainage to reach a drilling site, a temporary stream crossing would be constructed at right angles to the channel with adequate embankment protection and installation of properly sized culverts. Once the drill location was reclaimed and seeded, the stream crossing would be removed and any surface damage reclaimed and seeded.***
- ***Mobilization of the drill rig from hole to hole would be restricted to dry or frozen ground conditions.***

Reclamation

- ***Following the completion of any construction activity (6 months to 1 year), the disturbed areas surrounding the facility, individual wells, pipelines, and roads would be reclaimed. Large disturbed areas would be reclaimed. Large disturbed areas would be reclaimed before new areas are disturbed.***
- ***Following cleanup of the site and removal of contaminated materials, the evaporation ponds would be graded to their approximate original contour. Grading would include the replacement of approximately 56,400 cy of material excavated during the construction of the evaporation ponds. Topsoil would be replaced and the area seeded.***
- ***Following decontamination, the roads would be ripped and/or disked to relieve compaction. Excess imported gravel would be removed. Culverts would be removed and pre-mine drainages reestablished. All roads and ditches to be reclaimed would be graded and contoured to blend with the surrounding terrain.***
- ***All disturbed surfaces would be scarified and contoured, if necessary, followed by topsoil placement and seeding with the approved seed mix.***
- ***Areas which were compacted would be scarified, ripped, and/or disked as necessary to relieve the compaction and prepare the sub-grade for topsoil placement. Where needed, the surface would be graded and contoured to approximate original contours and to blend with the surrounding topography. In areas that were stripped of topsoil, the salvaged topsoil would be re-applied in a single lift to avoid compaction. If necessary, the replaced topsoil would be disked to create a proper seed bed. Seed bed preparation would only be performed under appropriate soil and climatic conditions***

- ***The reclamation goal of the Project would be to return the land to a condition that will sustain the pre-mining land use of livestock grazing and wildlife habitat.***

2.3.9.8 Transportation

Construction/Operation

- ***Cameco intends to maintain the Dry Creek Road to ensure the safety of the employees and contractors onsite. Maintenance includes ensuring the road is graded to minimize ruts, keeping a crowned surface for proper drainage and the ditch line free of debris. If additional gravel is needed Cameco will work with Fremont County and the BLM to secure a material that is acceptable to all parties.***

2.3.9.9 Vegetation, Wetlands, and Noxious Weeds

General Construction

- ***Following completion of delineation drilling, well field design would locate injection and recovery wells outside the boundary of wetlands. Under the Proposed Action, wetlands temporarily could be disturbed for construction of roads. Cameco would work with the WDEQ and U.S. Army Corps of Engineers (USACE) to define jurisdictional wetlands, and comply with the Section 404 or Section 401 permitting process, as appropriate. These processes would include development of a mitigation plan.***
- ***Cedar Rim Thistle surveys will be completed 1 year prior to development of each mine unit and associated access roads within the modeled habitat boundary.***

Mine Unit Construction

- ***All fencing installed at the Project would be of a temporary nature to protect the well field areas during operations and to protect vegetated areas following reclamation. Fence design and specifications would follow the BLM specifications as they are the dominant land owner within the permit area.***

Operation

- ***Cameco would comply with Operations Plan requirements for noxious weeds. During operations and following surface reclamation, noxious weeds would be controlled by annual spraying, on an as needed basis. This procedure would continue until final bond release is obtained Noxious Weed Control would be performed only by individuals that have appropriate state and BLM pesticide certifications.***

Reclamation

- ***The seed mixture used would be comparable to mixes used on other reclamation mines in the area, and was approved by the WDEQ-LQD and the BLM in 2008. This mix was designed to establish a vegetative cover consistent with the pre-mining land use of livestock grazing and wildlife habitat. Should any approved seed varieties become unavailable or cost prohibitive, or more locally adapted species become available, reasonable substitutions could be made after prior consultation with and approved by the BLM and WDEQ-LQD.***
- ***The success of revegetation in meeting the land use goal would be assessed prior to application for bond release by utilizing the COMA method as described in WDEQ-LQD Rules and Regulations Chapter 3, Section 2(d)(vi)(C) and WDEQ-LQD Guideline No. 2-Vegetation (November 1997).***
- ***At the time of bond release on all areas, including previously disturbed and reclaimed areas, the actual methodology to be used for evaluating vegetation success would be submitted to WDEQ-LQD at least 6 months prior to field sampling. Revegetation would be***

considered successful when, at the end of the bonding period, the following has been demonstrated:

- ***The vegetation species of the reclaimed land are self-renewing under natural conditions prevailing at the site;***
- ***The total vegetation cover of perennial species (excluding noxious weed species) and any species in the approved seed mix is at least equal to the total vegetation cover of perennial species (excluding noxious weed species) on the area before mining;***
- ***The species composition and diversity are suitable for the approved post-mining land use; and***
- ***The above are achieved during one growing season, no earlier than the fifth full growing season on the reclaimed lands.***

- ***In the unlikely event that any trees must be removed, Cameco would inventory such trees prior to removal and include that information and replacement cost in the appropriate annual report and surety revision submitted to WDEQ-LQD.***
- ***In those areas where there were few or no noxious weeds prior to being affected by the ISR operations, Cameco would control and minimize the introduction of noxious weeds into the revegetated areas for at least 5 years after the initial seeding had taken place.***
- ***The primary method of revegetation would be the pitting and seeding method. In limited areas where pitting and seeding would potentially interrupt surface water flow, such as incised drainage channels, areas with slopes steeper than 3:1 and permanent topsoil stockpiles, drill or broadcast seeding would be utilized.***
- ***Storm intensity may affect the success of revegetation within a mine unit. Should a major event destroy a revegetation effort, Cameco would reseed and revegetate the disturbed area at the next available seeding window.***

Decommissioning

- ***All reclaimed areas would remain fenced for a period of at least 2 years, or until the vegetation is capable of renewing itself with properly managed grazing and without supplemental irrigation or fertilization.***
- ***The fencing would not be removed until the BLM and WDEQ agreed that the revegetated areas are ready for livestock grazing.***

2.3.9.10 Visual Resources

General Construction

- ***Aboveground facilities would be painted with low-reflectivity paints in colors that would blend with the natural environment. The BLM color chart would be consulted in selecting an appropriate paint color or colors.***

2.3.9.11 Water Resources

General Construction

- ***Both primary and secondary access roads would use culvert crossings at drainages.***

Operation

- ***Cameco would continue to work with the Nuclear Regulatory Commission and WDEQ to apply spill leak/detector monitoring devices that are acceptable to both agencies. The present accepted U.S. NRC and WDEQ-LQD fluid spill detection practice includes a***

catchment basin with a conductivity probe or level transducer for each injection and production well connected to a header house project logic control.

<u>Storm Water Management</u>

- ***Sedimentation would be controlled through the use of erosion control and channel stabilizing measures such as:***
  - ***ditches and berms;***
  - ***conveyance channels;***
  - ***rock/rip rap;***
  - ***outlet protection;***
  - ***sediment traps or basins;***
  - ***straw bale barriers;***
  - ***silt fence; and***
  - ***check dams.***
- ***Fuel storage areas would be managed to prevent off-site drainage to or from the area. All petroleum products stored at the site would be contained in approved and appropriately labeled aboveground containers. Secondary containment would be accomplished by berming and/or ditching the perimeter of the entire fuel storage area.***
- ***During active construction, qualified personnel would inspect disturbed areas, control measures, and locations where vehicles entered or exited the site, at least once every 14 calendar days and within 24 hours of the end of any precipitation and/or snow melt event which exceeds 0.5 inch. During seasonal shutdowns qualified personnel would inspect the site at least once every month, unless snow cover or frozen ground conditions exist over the entire site for an extended period with no melting conditions.***

2.3.9.12 Wildlife and Fisheries

<u>Mine Unit Construction</u>

- ***The drilling mud pits would be fenced using 4 feet high by 16 feet wide rigid wire grid fence panels wired to steel T-posts (hog panels) protect from human and animal intrusion until the contained fluid was removed or evaporated, at which time the pits would be refilled and the fencing removed.***
- ***Primary and secondary power distribution lines would be built to the latest approved methods. All of the distribution power in the well fields would be buried rather than be constructed overhead. To reduce potential electrocution and collision impacts to migrating and foraging migratory bird species, and to eliminate new perches for raptor and corvid species, thus reducing the potential for predation on greater sage-grouse, overhead power lines would employ anti-perching and anti-roosting devices.***
- ***Cameco will follow and abide by the Sage-grouse Executive Order (SGEO). Cameco would work with the WGFD as the lead agency when dealing with greater sage-grouse issues, as they have the management authority over greater sage-grouse. Cameco also would consult with USFWS and BLM to ensure a uniform and consistent application of the SGEO is followed.***
- ***To protect breeding raptor species, Cameco commits to conducting annual surveys in suitable habitat to identify active raptor nesting sites prior to construction and to avoid beginning construction in active raptor nest sites by implementing seasonal protection buffers zones (as established by USFWS).***

Operation

- ***In order to minimize potential adverse impacts from the evaporation ponds to terrestrial wildlife and special status species, Cameco will coordinate with the WDEQ, BLM, WGFD, and USFWS in developing mitigation action plans for the ponds and implement measures to remove, exclude, or deter wildlife use.***
- ***Proposed mitigation for raptor nests could include construction of alternate nest sites on natural features, or the erection of appropriately sized nesting platforms.***
- ***Site speed limits of 40 mph on primary roads, 30 mph on secondary roads, and 10 mph on 2-track roads would be implemented to reduce wildlife/vehicle collisions and generation of dust.***
- ***Signage would be posted in the GHPA to notify Project personnel that wildlife and livestock may be encountered along the road.***
- ***To protect bat species and migratory bird species, including raptors and waterfowl, Cameco would monitor storage ponds to ensure ponds are not used by bird species. If significant use is observed, Cameco would consult with the WDEQ, BLM, WGFD, and USFWS in developing mitigation action plans for the ponds. Such actions could include propane cannons, brightly colored pennants and predator silhouettes/decoys.***

2.4 Resource Protection Alternative

The Resource Protection Alternative (RPA) was developed to respond to public and agency input collected during the scoping ***process, and was modified based on comments provided on the Draft EIS (BLM 2012b).*** This alternative is similar to the Proposed Action described in Section 2.3, Proposed Action, of this document, in that it would involve the development of uranium deposits in the GHPA through implementation of the ISR process to remove uranium from the ore-bearing formation. The RPA would utilize the same ***construction and mining*** processes*,* and take place over the same time period as the Proposed Action**,** but ***would include*** the following changes implemented to reduce surface disturbance, travel to and from the GHPA, and impacts to soils, vegetation, and wildlife, as well as increase the number of workers and enhance reclamation speed and quality for the Project:

- **Annual Development Planning:** Surface disturbance and potential for soil compaction and erosion associated with construction in each mine unit would be reduced, and the potential for successful reclamation would be increased through submittal of an Annual Development Plan (ADP) to the BLM that would require delineation of specific areas to be disturbed along with procedures to ensure that actual disturbance remains within planned areas (Section ***2.4.1).***
- **Construction Timing Constraints:** The BLM would not allow ***installation*** of ***any part of the third mine unit*** until interim reclamation on ***at least 1 well field in the first mine unit constructed*** has ***achieved*** reclamation success criteria. Likewise, ***installation of well fields within the fourth mine unit to be constructed*** would not begin until interim reclamation ***on at least 1 well field within the second mine unit constructed*** is successful, and construction would not begin ***on well fields within the final mine unit*** until interim reclamation ***on at least 1 well field within the third mine unit constructed*** has been demonstrated to be successful (Section ***2.4.2)****.*
- **Closed Loop Drilling System:** Excavated drilling mud pits would be eliminated and replaced with closed loop systems for the management of drilling fluids (Section ***2.4.3).***
- **Disturbance Offset for Additional Satellite Facility:** Disturbance associated with construction and operation of a second satellite facility would be offset through a requirement for reclamation of an equal area of existing unreclaimed or poorly reclaimed disturbance within the GHPA (Section ***2.4.4)****.*

- **Additional On-site Processing:** Additional on-site processing would produce yellowcake slurry ***from resin*,** which would require fewer truck loads of ***uranium*** product to the Smith Ranch-Highland facility ***than would occur under the Proposed Action*** (Section ***2.4.5).***
- **Reclamation Goals and Timing:** Reclamation improvements would be realized through the use of rigorous reclamation goals and criteria ***based on requirements in the Lander*** **Proposed *RMP and Final EIS (BLM 2013),*** and by timely implementation of reclamation activities after completion of construction or operational activities (Section ***2.4.6).***
- **Burial of New Power Lines:** Impacts to wildlife would be reduced by burial of all new power lines (Section ***2.4.7).***

Under the RPA not all of the surface area within the mine units would be disturbed by construction activity as is assumed under the Proposed Action. As shown in **Table 2-3**, the construction disturbance is estimated to be approximately 50 percent of the area of each mine unit. Approximately 30 percent of a mine unit area would undergo interim reclamation after construction and the remaining 20 percent would remain disturbed during operation. The following subsections describe in detail the changes in operations under the RPA relative to the Proposed Action as described in Section 2.3, Proposed Action.

2.4.1 Annual Development Planning

In order to reduce the surface disturbance associated with mine unit development the BLM would require submittal of an ADP prior to initiating surface***-disturbing*** activities for each calendar year. This plan would show in detail all areas of proposed surface disturbance and how all areas would be accessed by mechanized equipment for well drilling, well construction, and installation of underground utilities and overhead power lines. The plan also would show the locations of roads, header houses, valve boxes, and other features that would remain in place during mine unit operation. The overall goal of the plan would be to limit surface disturbance activities to less than the entire mine unit during construction activities and to eliminate cross-country travel during mine unit operations. Based on typical drill site layout (**Figure 2-6** and **Figure 2-7**)*,* and ***on estimated areas of disturbance within a*** typical ***well field*** pattern (***Appendix B,* Figure *B-5,***) the BLM estimates that annual planning would result in ***up to*** 50 percent reduction in surface disturbance during mine unit construction and would reduce impacts from cross-country travel by approximately 30 percent during mine unit operations.

Prior to any surface-disturbing activity, all areas of disturbance, including 2-track access routes for mechanized equipment, would be flagged and surveyed to establish Global Positioning System (GPS) coordinates. During construction activity all mechanized equipment would be required to remain within the flagged area including during access to well sites; cross-country travel outside of flagged areas would be prohibited.

Cameco would designate reclamation coordinators responsible for ensuring that the practices identified in the ADP are followed, including any required monitoring and reporting. A reclamation coordinator would be on-site any time surface-disturbance ***occurred,*** particularly during more intense construction activities such as well drilling and installation of underground utilities. The reclamation coordinator would have sufficient training in soils to provide expert input on the amount of soil to be removed when stripping topsoil and would be responsible for implementing the ***Topsoil Management Plan (***TMP*)* and adjusting the plan to changing field conditions throughout the life of the Project. An objective of the TMP would be to ensure topsoil segregation to maintain topsoil viability, as proper segregation of topsoil is critical to successful reclamation. The reclamation coordinator would be responsible for documenting, by using photographs or other means approved by the BLM, that travel of mechanized equipment did not occur outside of flagged areas. Photographs also would be taken at surface water monitoring sites listed in Section 2.3.8, Existing Monitoring Plans.

Table 2-3 Resource Protection Alternative Disturbance Summary

Mine Component	Disturbance (acres) Construction/Decommissioning (+15 percent)[a]	Disturbance (acres) Operation (+15 percent)[a]
Mine Unit Disturbance, Including Monitoring Well Ring		
Mine Unit 1[b]	78 (90)	31 (36)
Monitoring well ring for Mine Unit 1[c]	11 (13)	4 (5)
Mine Unit 2[b]	183 (210)	73 (84)
Monitoring well ring for Mine Unit 2[c]	10 (12)	3 (3)
Mine Unit 3[b]	45 (52)	18 (21)
Monitoring well ring for Mine Unit 3[c]	10 (12)	3 (3)
Mine Unit 4[b]	128 (147)	51 (59)
Monitoring well ring for Mine Unit 4[c]	9 (10)	3 (3)
Mine Unit 5[b]	56 (64)	22 (25)
Monitoring well ring for Mine Unit 5[c]	8 (9)	3 (3)
Subtotal for Mine Unit Disturbance	**538 (619)**	**211 (242)**
Project Infrastructure Outside of Mine Units		
Roads/Utility Corridors [d]	***209***	***38***
Surface Facilities		
Carol Shop Facility [e]	***0***	***0***
Satellite Facility [f]	***0***	***0***
Evaporation Ponds and Diversions [g]	***62 (66)***	***62 (66)***
Disposal Wells[h]	***6***	***3***
Topsoil Stockpiles	***3***	***3***
Subtotal for Disturbance Outside of Mine Units	***280 (284)***	***106 (110)***
Grand Total	***818 (903)***	***317 (352)***

[a] Mine unit area may expand based on results of delineation drilling, to account for this possible expansion, disturbance estimates for mine units and their associated monitoring well rings are conservatively increased by 15 percent.

[b] Disturbance of approximately 50 percent of each mine unit is anticipated during construction and decommissioning. Operational disturbance (primary and secondary roads, header houses, paths to each wellhead, valve boxes, and well heads) is conservatively estimated to be 5 percent of the mine unit area. An estimated 15 percent of the mine unit would be disturbed by planned trails (6 feet in width) to provide access to wellheads from header houses for a total disturbance of 20 percent of a mine unit during operation. The remaining portion of the mine unit disturbed during construction (30 percent of the total mine unit area) would undergo interim reclamation for the duration of operations.

[c] Construction disturbance for monitoring well rings is based on a disturbance width of 18 feet. Operational disturbance for monitoring well rings is based on a disturbance width of 6 feet.

[d] Road/Utility corridor construction disturbance for new, existing, and upgraded existing roads is based on a width of 60 feet for primary roads, 40 feet for secondary roads, 50 feet for underground utilities and 30 feet for buried power lines. Road/Utility corridor operational disturbance based on a width of 30 feet for primary roads, and 15 feet for secondary roads; utility corridors would undergo interim reclamation during operations. Includes disturbance for approximately 1.4 miles (8.3 acres, based on a 50-foot-wide disturbance) for a process water pipeline that would not be adjacent to a proposed road.

[e] Carol Shop facility is located on 27 acres of existing disturbance and would not involve new disturbance under the ***RPA***.

[f] The disturbance for both proposed satellite facility locations was considered although only 1 would be constructed. Disturbance for each location (approximately 5 acres) includes the building plus additional area for parking and access, and would be offset by reclamation of a corresponding area. Therefore, disturbance within the GHPA due to this activity is considered to be 0 acre.

[g] Disturbance associated with evaporation ponds 1 and 2 could each be increased by 2 acres for a total disturbance increase of 4 acres to accommodate additional evaporative surface area.

[h] Based on disturbance of 2 acres for construction and 1 acres for operation of each of 3 proposed disposal well locations. Two deep disposal test wells were drilled in 2011 and preliminary testing occurred in 2012; further development will require re-disturbance.

The ADP would include designated access trails (assumed to be 6 feet in width) between header houses and wells within mine units to be used for accessing wells during operations. In addition, low-impact all-terrain vehicles would be used to access wells and would be restricted to these designated trails for all monitoring, maintenance, and operations-related activity. Cross-country travel outside of designated trails would be prohibited during operations.

2.4.2 Construction Timing Constraints

To ensure that interim reclamation could successfully ***be*** achieved within the GHPA, the BLM would require a demonstration that reclamation methods would meet BLM criteria for successful reclamation. Construction and reclamation of ***the first*** and ***second mine units*** would be used to demonstrate successful reclamation. Only the infrastructure needed for ***the first*** and ***second mine units*** would be constructed before interim reclamation success has been demonstrated.

Reclamation success would be based on a quantitative demonstration that vegetation establishment on reclaimed areas was trending toward criteria set forth in Appendix ***D*** (Reclamation Objectives and Standards) of the Lander ***Proposed*** RMP ***and Final EIS*** (BLM ***2013) (Appendix D)****.* If reclamation does not appear to be approaching those criteria, adaptive management would be applied to the reclamation process, and further mine unit construction would be delayed until alternate reclamation methods had been identified and demonstrated to meet success criteria. Specifically, the BLM would not allow ***installation of any part of the third unit*** to ***be constructed*** until successful interim reclamation ***on at least 1 well field in the first mine unit constructed*** has been achieved. *I****nstallation of any part of the fourth mine unit to be constructed*** would not start until successful ***interim*** reclamation ***on at least 1 well field in the second mine unit constructed*** has been achieved, and ***installation of any part of the final mine unit to be constructed*** would not ***occur*** until successful ***interim*** reclamation has been achieved ***on at least 1 well field in the third mine unit constructed.***

2.4.3 Closed Loop Drilling Systems

To reduce the amount and intensity of surface-disturbance the BLM would require the use of closed loop drilling mud systems instead of excavated mud pits for the management of drilling fluids and cuttings during the drilling of all wells within the GHPA. The drill site layout would be the same as for the Proposed Action (**Figures 2-6** and **2-7**) except that the mud pit and associated topsoil and subsoil piles would be eliminated and replaced with aboveground tanks with interconnecting hoses placed on the ground surface that would contain all drilling fluids and cuttings. Use of closed loop drilling systems would eliminate the excavation of drilling mud pits and the associated topsoil and subsoil piles.

The closed loop mud rotary drilling technique is identical to standard mud rotary drilling except that the drilling fluid is circulated through a container on-site rather than circulated through a pit. Mud tanks, tubs, or portable pits are used in a multitude of different sizes and configurations depending on drilling conditions (depth and diameter of hole, geology, etc.) to separate drill cuttings from the drilling mud by screen or settling (or both). The drilling mud is then recirculated down the borehole leaving the drill cuttings behind in the mud container. Upon completion of each well drill cuttings would be disposed of at a centralized location within the mine unit or at an off-site location instead of burial within a drilling mud pit.

In addition to reducing surface-disturbance associated with excavation of drill pits, the use of closed loop drilling systems could reduce water use during drilling, enable recycling of water and drilling mud between wells, and facilitate improved reclamation by eliminating excavation of subsoils.

2.4.4 Disturbance Offset for Additional Satellite Facility

Under the RPA the BLM would require the reclamation of existing unreclaimed or poorly reclaimed surface-disturbance in the GHPA to offset surface-disturbance associated with construction and operation of an additional satellite facility. As a result, there would be no net increase in surface-disturbance associated with the construction of an additional satellite facility. Offsets for the satellite facility would include areas such as reclaimed roads, reduced size of header houses or the Carol Shop facility, reclamation of pre-Project disturbance, or other actions selected by Cameco and approved by the BLM. If a satellite facility is constructed, it would be the same as described for the Proposed Action in Section 2.3.1.1, Satellite Facilities.

2.4.5 Additional On-Site Processing

The Smith Ranch-Highland facility is authorized to receive and process yellowcake slurry source material as well as ion-exchange resin under license ***SUA-1548*** from the U.S. NRC. Under the Proposed Action approximately 1 truck load per day of uranium bonded to ion-exchange resin would be transported to the Smith Ranch-Highland facility for further processing. In this alternative, Cameco would conduct further processing of the ion-exchange resin at the Gas Hills facility to produce yellowcake slurry, which would then be transported to the Smith Ranch-Highland facility. Because the uranium concentration in yellowcake slurry is higher than in ion-exchange resin, the advantage of this alternative would be the transportation of fewer loads of material to the Smith Ranch-Highland facility. Due to this advantage, the BLM is analyzing this additional processing step as part of the RPA to enable comparison of the environmental impacts of slurry transportation with those of resin transportation under the Proposed Action. ***The BLM has the option to select 1 or both processing methods in the ROD.***

Under this alternative Cameco would conduct several additional processes at the Gas Hills facility, including resin transfer and elution, uranium precipitation from solution, and uranium precipitate dewatering to produce yellowcake slurry. These additional steps are outlined in **Figure 2-10** and are discussed in more detail in the following subsections.

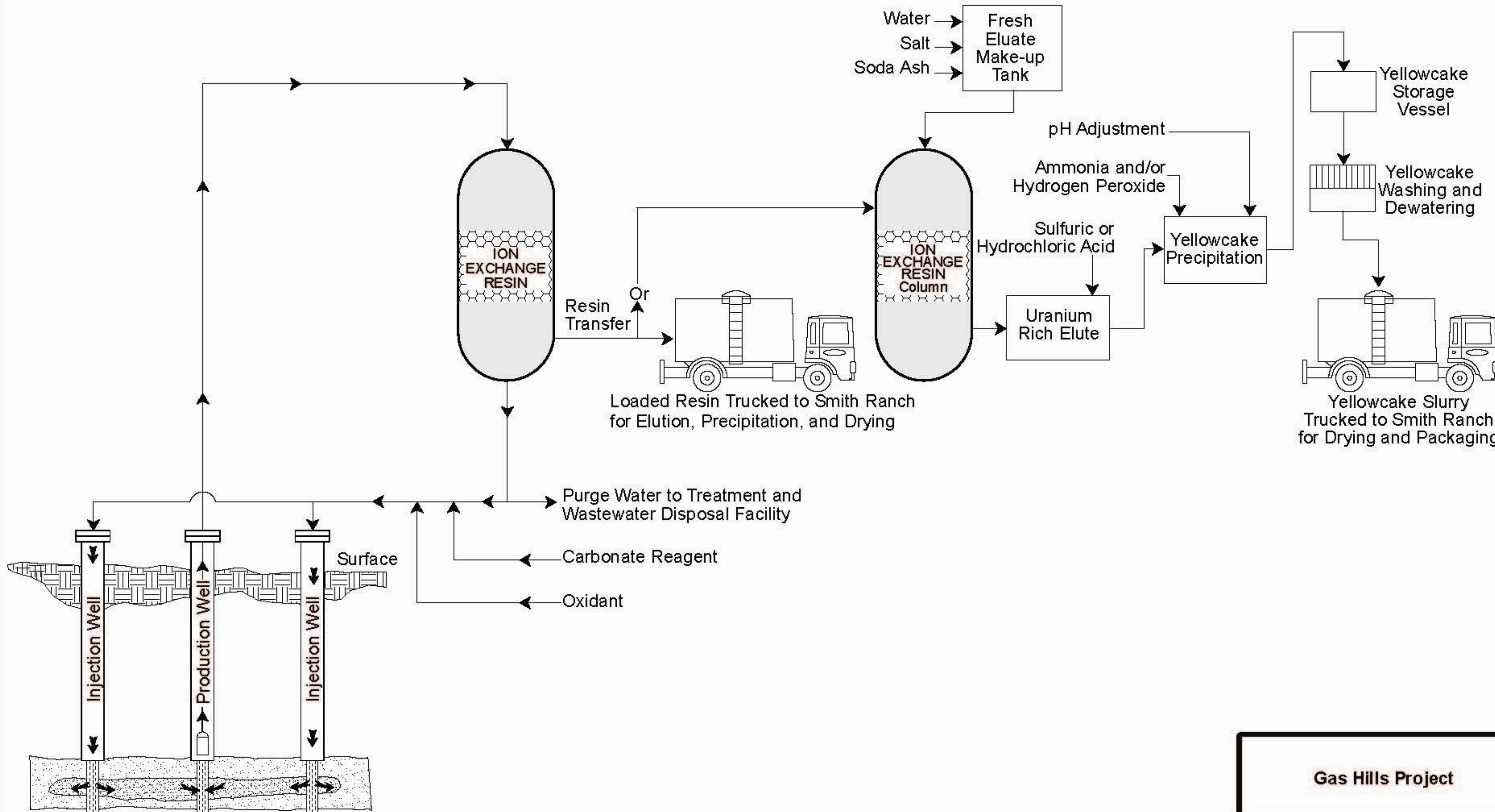
2.4.5.1 Resin Transfer and Elution

As discussed in Section 2.3.3.1, In-situ Recovery, uranium-laden groundwater would be treated using ion-exchange technology. The water would be pumped to the satellite facility where uranium would be adsorbed to ion-exchange resin beads that preferentially remove uranium from the solution. Once the resin in a column was sufficiently bonded with uranium, the column would be isolated from the normal process flow and the resin would be transferred into another column for uranium elution (also known as stripping), a process whereby the uranium is removed from the resin.

In the elution process, the resin would be contacted with a strong sodium chloride/sodium carbonate solution, which would displace (or strip) the uranium from the resin in a process very similar to regenerating a conventional home water softener. The eluted (stripped or regenerated) resin would be washed and then placed back in service for additional uranium recovery. The uranium rich fluid (rich eluate) would be pumped to the precipitation circuit for further processing.

2.4.5.2 Precipitation Circuit

The rich eluate containing the uranium would be routed to tanks for temporary storage ahead of the batch or continuous precipitation circuit. To initiate the precipitation cycle, hydrochloric or sulfuric acid would be added to the uranium-bearing solution to convert the uranyl carbonate present in the solution to uranyl chloride or uranyl sulfate, both soluble species for precipitation. Hydrogen peroxide and sodium hydroxide would then be added to the acidified eluate to effect precipitation of the uranium as uranyl peroxide or sodium diuranate. The addition of hydrogen peroxide would lower the pH of the solution, and sodium hydroxide would be added as a pH adjustment to optimize crystal growth and settling. After allowing the uranium precipitate to settle, the uranium-depleted supernate solution would be removed and stored for re-use in future elutions as lean eluate, pumped to the evaporation ponds/water treatment circuit, or disposed via deep disposal well (Section 2.3.1.2, Waste Management). Sodium chloride and sodium carbonate would be added to the lean eluate as needed for reconstitution.



Source: PRI 2009, Figure 1.

Gas Hills Project

Figure 2-10

Diagram of Slurry Production

2.4.5.3 Precipitate Dewatering, Filtration and Transport

The resulting slurry from the precipitation circuit would be transferred to a storage vessel, allowing the uranium to settle and consolidate by gravity. The precipitated and thickened yellowcake slurry would then be sent to a filter press for washing to remove soluble contaminates and then de-watered prior to transport to the Smith Ranch-Highland facility. The dewatered yellowcake slurry product would be placed into USDOT approved containers and transported to the Smith Ranch-Highland facility in exclusive-use, USDOT authorized transport vehicles.

2.4.5.4 Additional Materials, Equipment, Energy Use, and Workforce

Additional material and chemicals that would be required to produce yellowcake slurry include additional water for eluate make-up solutions and product washing, sodium chloride and sodium carbonate for eluate make-up solutions, sulfuric and/or hydrochloric acid for pH control, and sodium hydroxide and hydrogen peroxide for precipitation. Cameco estimates the increase in water use for slurry production to be a maximum of 56 acre-feet per year from existing sources, which would correspond to an increase in consumptive water use and disposal of an additional 13 percent relative to the Proposed Action.

Additional equipment items would be located in the existing Carol Shop facility or in the second satellite facility and would include tanks for preparation and storage of eluate make-up solutions, rich eluate, precipitation, and slurry storage. A storage vessel and a filter press also would be required to complete the process. The elution/precipitation portion of the recovery plant circuit would be designed for batch or semi continuous operations. The number of batch cycles would be increased with uranium production increases. The elution circuit would operate under automated controls.

The major power requirements of an in-situ uranium facility involve the primary extraction circuit (i.e., the well fields and associated plant circuitry). Power requirements to operate the elution and precipitation circuits are insignificant in comparison to power needed for the primary extraction circuit. Therefore, a moderate increase in power demand would be anticipated under this alternative which could be provided by the existing electrical service to the GHPA.

Cameco projects that an additional 10 workers would be required at the GHPA to carry out activities related to resin elution and yellowcake slurry generation.

2.4.5.5 Yellowcake Slurry Transport

Under this alternative yellowcake slurry would be transported to the Smith Ranch-Highland facility for further processing (drying and packaging) into yellowcake for shipping. Assuming an average production rate of 1.1 million pounds of uranium per year, the estimated number of truck loads to the Smith Ranch-Highland facility carrying yellowcake slurry would be 122 trips per year. This would be a reduction compared to the estimated 325 truck loads of resin that would be transported to Smith Ranch-Highland facility under the Proposed Action. This reduction would be partially offset by additional chemical deliveries, estimated at 1 per month per bulk chemical for hydrogen peroxide, sulfuric acid, sodium carbonate, sodium chloride, and sodium hydroxide equating to approximately 5 bulk deliveries per month. Overall, the number of transportation trips associated with yellowcake slurry production would be reduced to about ½ of those needed for the Proposed Action.

2.4.6 Reclamation Goals and Timing

In order to promote improved reclamation with the GHPA, the BLM would require prompt reclamation of disturbed areas and the use of reclamation goals appropriate to the site's ecological potential even if the pre-disturbance vegetation included a less diverse plant community. This approach would establish a post-mining landscape closer to historic conditions present in the GHPA prior to any mining of the area rather than re-establishment of the current conditions which have been degraded by historic mining and grazing activities (BLM 1998***a***). The following sections provide more detailed descriptions of the criteria and requirements that BLM would use to enhance reclamation within the GHPA.

2.4.6.1 Reclamation Success Criteria

In order to enhance reclamation results within the GHPA the BLM would require the evaluation of reclamation success using the reclamation criteria established in **Appendix D of** the Lander **Proposed** RMP **and Final EIS** (BLM **2013) (Appendix D of this document).** The basis for these criteria is the **UDSA-**NRCS ecological site descriptions **ecological site descriptions** (ESD) for each mapped ecological site found in the GHPA (USDA-NRCS 2011). An ecological site is a landform with specific physical characteristics that differ from other landforms in its ability to produce distinctive kinds and amounts of vegetation and in its response to management. For an individual ecological site the **USDA-**NRCS and the BLM have developed (or are in the process of developing) ESDs to provide qualitative and quantitative data about an ecological site's biological and physical characteristics. To evaluate the functional status of an ecological site, 17 easily measurable or observable indicators have been identified that correlate with the biological and physical characteristics of an ecological site. Indicators for a site are defined in each ESD.

Criteria based on the ESD indicators for the ecological sites in the GHPA that would be used to evaluate interim reclamation success within a mine unit **are summarized in Table 2-4. Criteria that would be used to evaluate final reclamation success are summarized in Table 2-5.**

The reclamation requirements for percent ground cover shown in Tables 2-4 and 2-5 are listed as a percent of the erosion indicator as listed on USDA-NRCS Reference Sheet for Ecological Sites. For example, if the erosion indicator is 50 percent for a particular Ecological Site, the percent of ground cover for interim reclamation would need to be 80 percent of the 50 percent indicator. Therefore, interim reclamation would be deemed successful with a total of 50 percent of 80 percent, or 40 percent ground cover. Ground cover includes litter, rock, and plant cover. The USDA-NRCS reference sheets for the Ecological Site erosion indicators take into account the natural vegetation composition, cover, and density in the area, which accounts for areas with high percentages of bare ground, rock, or litter.

Table 2-4 Interim Reclamation Standards for Designated Development Areas
(Reclamation will be considered successful 3 years after seeding if the following criteria are met)

Site Characteristics	**Standards**
Percent Ground Cover	**80 percent of the erosion indicator as listed on USDA-NRCS Reference Sheet for Ecological Site is met**
Plant Species Composition (by weight)	• **At least 65 percent total plant species must be from major grasses, forbs, and/or shrubs listed in the Ecological Site Desired Plant Community and/or BLM, authorized plant species from seeding mix** • **No greater than 15 percent of the total reclaimed disturbance will be composed of non-designated invasive species** • **No greater than 35 percent of a 500-square-foot contiguous area within a reclaimed disturbance will be composed of non-designated invasive species** • **No designated federal and state invasive plant species present**
Site Stability, Erosion Potential, and other Variables	**Meet USDA-NRCS Reference Sheet Indicators for Ecological Site with the following exceptions:** • **Soil Surface Structure and Soil Organic Matter content** • **Average Percent of Litter Cover and Depth** • **Expected Annual Production** • **Functional/Structural Groups**

Table 2-5 Final Reclamation Standards for Designated Development Areas
(Reclamation will be considered successful 3 years after seeding if the following criteria are met)

Site Characteristics	Standards
Percent Ground Cover	**90 percent of the erosion indicator as listed on USDA-NRCS Reference Sheet for Ecological Site is met**
Plant Species Composition (by weight)	**At least 80 percent total plant species must be from major grasses, forbs and/or shrubs listed in the Ecological Site Desired Plant Community and/or BLM authorized plant species from seeding mix** **At least 5 percent of the total plant species must be woody plants as listed in the Ecological Site Desired Plant Community[a]** **At least 5 percent of the total plant species must be forbs as listed in the Ecological Site Desired Plant Community** **No greater than 10 percent of the total reclaimed disturbance will be composed of non-designated invasive species** **No greater than 25 percent of a 500-square-foot contiguous area within a reclaimed disturbance will be composed of non-designated invasive species** **No designated federal and state invasive plant species present**
Site Stability, Erosion Potential, and Other Variables	**Meet USDA-NRCS Reference Sheet Indicators for Ecological Site with the following exceptions:** **Soil Surface Structure and Soil Organic Matter content** **Average Percent of Litter Cover and Depth** **Expected Annual Production** **Functional/Structural Groups**

[a] **Woody vegetation would include seedlings in the reclaimed area.**

Cameco would be required to submit and comply with the requirements of a noxious weed plan. The plan would identify the frequency of inspection for noxious weeds and herbicide spraying by a certified applicator. The BLM recommends, but does not require, that Fremont County Weed and Pest Department be consulted in the development of the plan. Control of noxious weeds would be met by whatever treatments necessary rather than the Proposed Action’s annual spraying. Noxious weed control would be maintained around all facilities, including roads and all areas undergoing interim reclamation.

2.4.6.2 Reclamation Timing

Reclamation of construction disturbance would be started as soon as possible; as a minimum of construction was completed. Reclamation of soil disturbed to install pipelines would begin as soon as practical following construction seeding occurring during the next available seeding window.

Removal of buried infrastructure would be limited to the equipment identified by the U.S. NRC and/or the WDEQ; infrastructure that could be left in place such as buried power lines would not be removed. Reclamation of the vegetation and soils resulting from infrastructure removal would begin concurrently with removal.

Any infrastructure outside of the mine units not required for groundwater restoration or the operation of subsequent mine units would be decommissioned and reclaimed as soon as possible. Facilities would be decommissioned and reclaimed if obsolete to further plant operations.

2.4.7 Burial of New Power Lines

Approximately 21 miles of new power lines are anticipated to be constructed to supply Project components with electricity. Under this alternative, new power lines would be buried within road ROWs rather than be constructed overhead. However, burial of new power lines would have no impact on construction or operational disturbance, but would reduce potential electrocution and collision impacts to migrating and foraging migratory bird species, and would eliminate new perches for raptor and corvid species, thus reducing the potential for predation on greater sage-grouse.

2.5 BLM-Preferred Alternative

The BLM-Preferred Alternative (BPA) was developed in response to comments received on the Draft EIS during the public review process. This alternative would consist of Cameco's PoO as summarized in Section 2.3 (Proposed Action) with several additional elements derived from the RPA (Section 2.4). The BPA would utilize the same processes and take place over the same period of time as the Proposed Action; however, the RPA elements included in this alternative have been revised to reflect public and agency input during the review of the Draft document. The description of how resource protection measures would be incorporated into Cameco's operations also is expanded. The following additions to the Proposed Action would be implemented under this alternative to reduce the adverse impacts from surface-disturbance, increase the potential for reclamation success, and protect wildlife, soils, and vegetation.

- ***Annual Development Planning and Reporting: The BLM would require submittal of an ADP by Cameco, and approval of the ADP by BLM prior to initiating surface disturbance activities for each calendar year, including infrastructure development, mine unit construction, mine unit restoration and reclamation, or final Project reclamation and decommissioning. This submittal would be similar to the ADP described in Section 2.4.1. The ADP would be included with Cameco's annual reporting requirements to the BLM, and would be in addition to information required for yearly submittal to WDEQ-LQD listed under item 6 in Appendix E. Section 2.5.1 provides a description of additional information that would be required to be provided in the annual report that is not currently required by WDEQ. The ADP would include:***

    a. ***Designation of a Reclamation Coordinator: Among other duties assigned by Cameo, Cameco's reclamation coordinator would provide oversight for site-specific reclamation and topsoil handling activities (Section 2.5.1.1).***

    b. ***Site-specific Reclamation Plans: Cameco would submit to BLM a detailed reclamation plan for each year's plan and construction disturbance in compliance with the Wyoming BLM Reclamation Policy (Appendix F) including well field level topsoil handling plans based on site-specific conditions within each planned disturbance area, determined by soil and vegetation characteristics, prior to commencing well field installation. Well field level information for each development would be used to produce plans specific to each mine unit. Information would be gathered during pre-site investigations and delineation drilling then submitted to BLM during the annual development planning and reporting (Section 2.5.1.2).***

    c. ***Reclamation Success Criteria: Similar to reclamation success criteria discussed in Section 2.4.6, Cameco would provide documentation of interim or final reclamation success based on standards listed in Appendix D of the Lander Proposed RMP and Final EIS (BLM 2013, Appendix D), and summarized in Tables 2-4 and 2-5 (Section 2.5.1.3).***

d. Use of Existing Access Roads: Cameco would be required under this alternative to make use of existing access roads, where applicable, to access mine units and facilities (Section 2.5.1.4).

- ***Construction Timing Constraints: As discussed in Section 2.4.2, BLM would not authorize well field installation within the third mine unit to be constructed until interim reclamation on at least 1 well field in the first mine unit to be constructed is successful, and other well fields show significant progress towards meeting interim reclamation success described under Annual Development Planning and Reporting (Section 2.5.1).***
- ***Additional On-site Processing: Additional on-site processing could be utilized to produce yellowcake slurry instead of resin beads for shipment to the Smith Ranch-Highlands facility, as described in the RPA (Section 2.4.6). This portion of the BPA would be available as an option to Cameco under this alternative.***

Under the BPA and Proposed Action, it is assumed that 100 percent of each mine unit would be disturbed by construction activities, whereas, under the Resource Protection Alternative, it is assumed that 50 percent of the mine unit would be disturbed. While the implementation of local reclamation and management plans, annual development planning and reporting, use of existing roads, and oversight by a reclamation coordinator would reduce the intensity of impacts, potentially reduce the amount of disturbance, and enhance reclamation success, these benefits would not be fully defined until development for each year is planned, submitted, and approved. Operational disturbance also would be similar to that estimated for the Proposed Action, and therefore, the construction and operation disturbance shown in Table 2-1 (Proposed Action) is conservatively estimated to be the disturbance under the BPA. Additional on-site processing and reclamation timing constraints would not limit disturbance but would decrease impacts to transportation and enhance reclamation success. The following subsections describe in detail, the measures that would be implemented under the BPA, and how these measures would be incorporated into Cameco's operations.

2.5.1 Annual Development Planning and Reporting

Annual development planning and reporting would be the mechanism for the proponent to describe the past year's operation and reclamation activities as required by the WDEQ-LQD through Annual Reporting, as well describe and plan for the upcoming year's activities. Similar to the ADP described in Section 2.4.1, the BLM would require submittal of an ADP prior to initiating surface-disturbing activities for each calendar year. This plan would detail all areas of proposed surface disturbance and indicate how all areas would be accessed by mechanized equipment for construction, restoration, decommissioning, or reclamation activities. Any additional adjustments to activities such as implementation of increased dust control measures or Timing Limitation Stipulations (TLS) in mule deer winter yearlong range also would be defined through this process. The plan also would show the extent of disturbance associated with locations of roads, header houses, valve boxes, and other features to be constructed each year that would remain in place during mine unit operation.

The goal of this annual reporting requirement would be to provide the BLM additional information to help manage surface-disturbing activities, enhance the potential for reclamation success, and ensure compliance with the mitigation measures/stipulations defined in this EIS. In addition to the information specified for annual reports by WDEQ (see Appendix E), the BLM would require:

- ***Designation of a reclamation coordinator as described in Section 2.5.1.1;***
- ***A detailed Site-specific Reclamation Plan, described in Section 2.5.1.2 including:***
  - ***Topsoil handling and management procedures,***
  - ***A description of the proposed methods for managing avoidance of designated areas or areas with TLS (e.g., for cultural resources, wildlife habitat, or paleontological discoveries), and***
  - ***Geographic Information System (GIS) shape files or other digital data illustrating the upcoming year's proposed disturbance areas.***
- ***Measurements of previous reclamation success relative to the criteria cited in Section 2.5.1.3; and***
- ***Locations of existing roads to be improved during the next year for Project use, as described in Section 2.5.1.4.***

2.5.1.1 Reclamation Coordinator

Cameco would identify a Reclamation Coordinator to develop the site-specific reclamation plans and train or instruct equipment operators as to the required soil handling techniques relative to each area. This person also would provide oversight for topsoil handling and reclamation for all activities associated with the Project. The designated individual would have sufficient training in soils and reclamation techniques to provide expert input to the annual development planning. This position would coordinate with BLM to adjust the plans to reflect changing field conditions throughout the life of the Project. The reclamation coordinator also would be responsible for documenting reclamation success and including that documentation in the annual reports.

2.5.1.2 Site-specific Reclamation Plans

Cameco would be required to provide the BLM with a site-specific reclamation plan for each year's construction that would incorporate individual site information gathered within each planned disturbance area. Cameco has committed to identify site-specific topsoil depths during delineation drilling and submit that information to the WDEQ as part of its hydrologic test proposal or annual report. BLM also would require Cameco to describe existing vegetation at the well field level and to determine the proposed reclamation potential of each well field based on the existing soil and vegetation characteristics. Cameco would then utilize that information to develop a mine unit site-specific reclamation plan in accordance with the Wyoming BLM Reclamation Policy (Appendix F) and Appendix D of the Lander Proposed RMP and Final EIS (BLM 2013) (Appendix D). Information could vary between well fields within a mine unit based on site-specific characteristics. The BLM would review this information as part of the annual development planning and reporting and determine if the proposed reclamation plan is adequate for each site, taking into consideration all factors including wildlife and cultural resources.

In addition to reclamation activities generally addressed in Cameco's current reclamation plan (PRI 2009, as amended), summarized in the Proposed Action, the following requirements of the Wyoming BLM Reclamation Policy (Appendix F) would need to be addressed in the site-specific reclamation plans:

- ***Strategy to minimize and monitor sheet and rill erosion on or adjacent to the reclaimed area (Section B.3.d);***
- ***Strategy to reconstruct and stabilize stream channels, drainages and impoundments (B.4.b);***
- ***Methods to reduce compaction prior to topsoil redistribution (B.6.b);***

- ***Methods to enhance critical resource (e.g., wildlife, range, biodiversity) values through augmenting or accelerating restoration of the plant community (B.7.b);***
- ***Strategy for management of invasive plants (B.9); and***
- ***Strategy for monitoring reclamation success (B.10).***

<u>Topsoil Handling and Management Plans</u>

Cameco would be required to include topsoil handling and management plans based on information gathered within well fields of each mine unit. Under the Proposed Action, Cameco plans to develop site-specific topsoil stripping depths during delineation drilling and submit that information to the WDEQ as part of their hydrologic test proposal or annual report. The BLM would require yearly submittal of this information and also would require a review of existing vegetation within these areas and a determination of the reclamation potential of the area based on the existing soil and vegetation characteristics. The BLM would review this information as part of annual development planning and reporting and use it to select a topsoil handling and management plan for the area specified. Ideally, the selected plan would be applicable to either the entire well field or the entire mine unit; however, because site characteristics differ across mine units and well fields,a plan meant to protect the most sensitive soils would be implemented.

2.5.1.3 Reclamation Success Criteria

Interim reclamation success would be based on the standards for Designated Development Areas included in the Lander Proposed RMP and Final EIS (BLM 2013) (Table 2-4). Significant portions of the GHPA consist of Limited Reclamation Potential (LRP) soils. The principal goal of reclamation on LRP soils is soil stabilization and erosion control. Previously disturbed and subsequently reclaimed areas occur within portions of the GHPA on which reclamation success has not been adequately analyzed. These areas may not be considered LRP soils but often lack any conventionally viable topsoil. As a result, previously reclaimed areas in the GHPA are typically composed of less diverse vegetation (nearly entirely 1 grass type). Because reclamation success in these areas has not previously been documented, interim reclamation success of these areas would be determined during the annual development planning and reporting process, and the criteria provided in Table 2-4 would be utilized if an erosion indicator can be identified.

If initial reclamation efforts did not meet the applicable criteria, the BLM would require Cameco to employ adaptive management strategies that might include soil amendments, water farming techniques, reseeding, or other approaches that would be identified within Cameco's annual development planning and reporting.

Final reclamation success would be determined based on the on the standards for Designated Development Areas included in the Lander Proposed RMP and Final EIS (BLM 2013) (Table 2-5) which generally would require different standards than those described for the Proposed Action, especially for woody plants and forbs. Reclamation success in areas with LRP soils would be quantified using either BLM success criteria as defined in the Lander Proposed RMP and Final EIS (BLM 2013), or by the COMA method described in the Proposed Action, depending upon site characteristics. Final reclamation success of previously disturbed areas would utilize the criteria for Final Reclamation Standards for Designated Development Areas, if an erosion indicator can be identified. The annual development planning and reporting process would provide the platform for BLM and WDEQ to agree to the final standards associated with each mine unit, or for a more site-specific area. If reclamation does not appear to be approaching the applicable criteria, BLM would require Cameco to employ adaptive management strategies that might include soil amendments, water farming techniques, reseeding or other approaches identified by Cameco as part of their annual development planning and reporting.

2.5.1.4 Use of Existing Access Roads

Under this alternative Cameco would be required to utilize existing roads to access mine units and facilities wherever practicable. The GHPA is littered with unmaintained roads due to past mining and drilling activities, and in some cases the existing roads are located where they could provide adequate access to facilities and mine units as opposed to construction of new roads across previously undisturbed lands under the Proposed Action. Use of these roads would require disturbance to install pipelines and electricity, and many also would require improvements and drainage to meet BLM standards. However, in some instances the existing roads are poorly located or are in too poor of a condition for the type of access and use required for ISR activities, and newly constructed roads could be built in these areas to applicable standards as described under Section 2.3.1.3. Locations of roads to be constructed each year would be finalized during annual development planning; some of the existing roads that could be considered are shown in Figure 2-11. For the purposes of this analysis, it is assumed that all roads used for the Project would be disturbed for improvements and installation of pipelines and power lines, and total length of roads would be similar to that described under the Proposed Action.

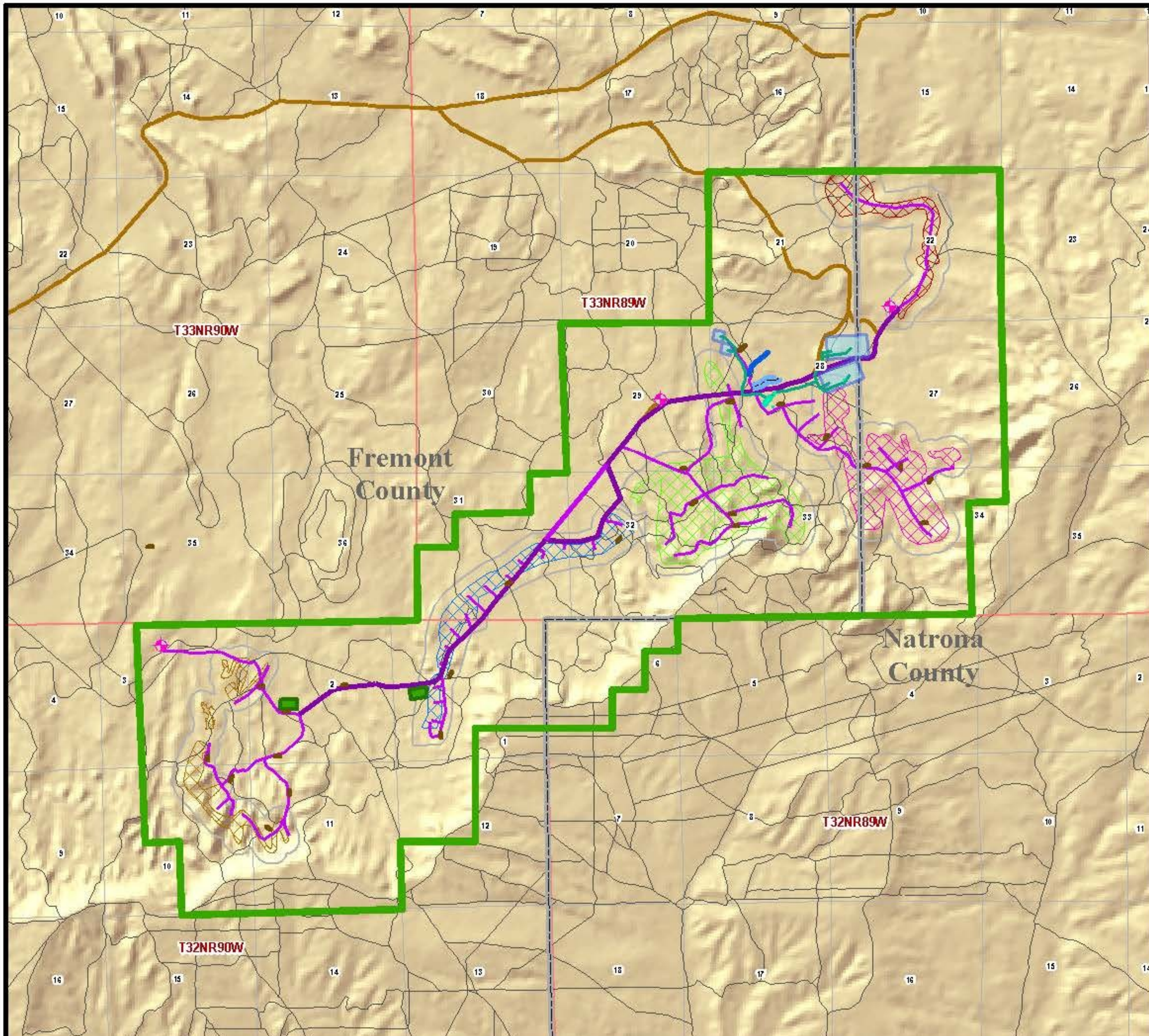
2.5.2 Construction Timing Constraints

This method would essentially be the same as described under the RPA, Section 2.4.2. However, the BLM would set definable and achievable criteria as presented in Section 2.5.1.3 based on reclamation potential of the soils within the disturbance area. BLM would not allow well field installation within the third mine unit to be constructed until interim reclamation on at least 1 well field in the first mine unit constructed (currently anticipated to be Mine Unit 1) is successful and other well fields show significant progress towards meeting interim reclamation success based on applicable criteria. Similar limits would be set on construction of subsequent mine units. For instance, construction on the fourth mine unit to be developed could not begin well field installation until interim reclamation in at least 1 well field of the second mine unit constructed meets applicable criteria as described below and other portions of the mine unit are trending towards success. Construction on the fifth and final mine unit to be developed could not begin well field installation until interim reclamation in at least 1 well field of the third mine unit constructed has met applicable criteria as described below and other portions of the mine unit are trending towards success. In addition, construction on the fifth mine unit to be developed could not begin until a portion of disturbance within the Project Area has undergone and successfully achieved the applicable final reclamation success criteria for that area.

Cameco's proposed timeline assumes that Cameco would be able to achieve interim reclamation at least as quickly as groundwater restoration is achieved; therefore, this requirement would not limit Cameco's ability to meet the proposed schedule shown under the Proposed Action. The timing requirements within the BPA would provide an incentive for Cameco to ensure that reclamation success would be achieved.

2.5.3 Additional On-site Processing

This portion of the BPA would allow Cameco the option to include additional on-site processing of resin beads into yellowcake slurry, as described in Section 2.4.5, in addition to the processing and transport of resin beads as described under the Proposed Action. As noted in Section 2.4.5, the Smith Ranch-Highland facility is authorized to receive and process yellowcake slurry source material as well as ion-exchange resin under license SUA-1548 from the U.S. NRC. Any on-site processing to yellowcake implemented by Cameco would require no additional construction disturbance, and would result in a reduction in shipments to the Smith Ranch-Highlands facility.



Gas Hills Project

Figure 2-11

Existing Roads

2.6 Alternatives Considered but Eliminated from Further Consideration

2.6.1 Conventional Mining

Conventional mining would involve the extraction of ore by open pit or underground mining, the processing of the ore in a mill, and the disposal of mill tailings waste in a surface impoundment. The environmental impacts associated with conventional mining would be greater than the corresponding impacts of an ISR uranium recovery facility. Conventional mining methods involve excavation of soil and rock to access ore for further processing. These methods result in disturbance of the ground surface and subsurface geological materials, require the use of heavy equipment and explosives, may require dewatering during mining, and would require more overall disturbance than ISR technology. Furthermore, the target ore zones may be too deep for open pit mining methods. Given the greater disturbance footprint and potential for impacts to groundwater, surface water, vegetation, soils and wildlife, conventional mining methods will not be analyzed in detail in the EIS.

2.6.2 Seasonal Operation

This alternative would involve seasonally limiting operation of mine units to limit activity within areas with wildlife ***TLS***. Control of subsurface fluids is maintained hydraulically through the injection and production process, which provides for an inward gradient within each mine unit. Because this process depends on the maintenance of constant groundwater flow gradients, the system cannot be shut down for short periods. Therefore, seasonal operation was not analyzed in detail in this EIS. ***Seasonal limitations on Project construction are described in Section 4.17.***

2.6.3 No Temporary Facility Closure

As stated in Section 2.3.6, Final Project Reclamation and Decommissioning, Cameco may elect under U.S. NRC regulations to place ISR operations under temporary standby for 24 months with possibility of extensions with U.S. NRC approval. The BLM was concerned that continued standby of ISR operations could result in cessation of processing activities and idling of the proposed facility without decommissioning and reclamation for an indeterminate period of time. However, under BLM's 43 CFR 3809, surface management regulations pertaining to mining-related activities (Section 3809.500), Cameco would be required to post a bond sufficient to cover the estimated costs of reclaiming the proposed operations. The bond would not be returned to Cameco until reclamation was complete, which would provide a monetary incentive for Cameco to reclaim the area, and to limit the length of a period of nonoperation. Furthermore, under Section 3809.424(a)(3), the BLM has the discretion to require removal of facilities and reclamation of the GHPA for a non-operating facility that has been inactive for 5 consecutive years. Due to these existing regulations the BLM determined it was not necessary to conduct a detailed analysis of this alternative in the EIS.

2.6.4 Reduced Number of Evaporation Ponds

The primary means for wastewater disposal would be through deep disposal wells installed in the GHPA. Deep disposal wells are often called deep injection wells, but the term deep disposal well is used in this document to distinguish them from the injection wells that are part of the ISR process. This would enable the construction of a reduced number of evaporation ponds which would be installed as back-up to the deep disposal wells. Two evaporation ponds (instead of 6 ponds under the Proposed Action) would be constructed as a secondary/backup water disposal method.

Cameco currently is evaluating the technical feasibility of developing deep disposal wells in the GHPA and is planning to submit a Class I Permit Application to the WDEQ. Even if Cameco is successful in obtaining a permit, the geologic condition beneath the GHPA may not accommodate the water disposal needs of the Project and all 6 of the proposed evaporation ponds may still be required. For these reasons the BLM determined that this alternative would not be analyzed in detail in the EIS.

2.6.5 Additional Transportation Routes

Potential alternate transportation routes of resin or slurry from the Gas Hills site to the Smith Ranch-Highland facility were considered. Potential alternative routes considered included using Fremont County Road 5 to Jeffrey City County Road 321 south to Highway 220, roads connecting Highway 136 with Moneta or Shoshoni (Buck Camp Road or Castle Gardens Road), or County Road 201 (Poison Spider Road) to Casper. Use of these roads could reduce mileage relative to the proposed winter route through Riverton. Many of these roads are not currently designed for frequent, heavy vehicle use, and are not maintained (plowed) during winter. Because travel during winter in the region may be hindered by snow and snow drifts, plowing snow during winter months is likely to be necessary on most routes. Because the majority of the preferred winter route to Casper (136 to Riverton, and Highways 26 and 20 to Casper) has been constructed to support projected Project traffic, the majority of these roads are currently plowed by the county during winter, and because costs associated with upgrades and plowing for alternative routes, detailed analysis of the identified potential alternate routes was not included in the EIS.

2.6.6 Alternate Waste Disposal Locations

This alternative would identify a U.S. NRC- ***or NRC-agreement State***-licensed site for disposal of radiologically contaminated waste materials that was closer to the GHPA than Blanding, Utah. Current estimates of potential volumes of radiologically contaminated waste to be generated by the Project would require a maximum of 20 truck loads of material per year for transport. Transportation of radiologically contaminated waste would represent a small portion of Project-related traffic, and use of a closer disposal site would not greatly reduce traffic impacts. Therefore, this alternative was not analyzed in detail in the EIS.

2.7 Comparison of Alternatives

During development of this document, the BLM determined that no lands with sufficient size, naturalness, or outstanding opportunities for either solitude or primitive and unconfined recreation to qualify as lands with wilderness characteristics were located either solely or partially within the GHPA. The area closest to the GHPA meeting those qualifications is located southeast of Dubois, Wyoming, approximately 100 miles northwest of the GHPA (BLM 2011b). Therefore, lands with wilderness characteristics are not further described, and impacts are not further discussed for any alternative within this document.

A summary of the surface disturbance associated with each of the alternatives is presented in **Table *2-6*.** A comparison of impacts associated with each of the alternatives is presented in **Table *2-7*.**

Table 2-6 Summary of Surface Disturbance for the Alternatives

Facility	No Action Alternative[a]	Proposed Action Alternative	Resource Protection Alternative	*BLM-Preferred Alternative*
Mine Units	0 (acre)	977 (acres)	490 (acres)	***977 (acres)***
Water Impoundments	0 (acre)	62 (acres)	***62*** (acres)	***62 (acres)***
Disposal Wells	0 (acre)	6 (acres)	6 (acres)	***6 (acres)***
Roads-Primary (2-way traffic, maintained)[b]	11 (acres) 1.8 (miles)	90 (acres) 8.0 (miles)	90 (acres) 8.0 (miles)	***90 (acres) 8.0 (miles)***
Roads-Secondary (1-way traffic, maintained)[c]	0 (acre)	111 (acres)	111 (acres)	***111 (acres)***
Roads-2-track (not maintained) includes monitoring well rings[d]	0 (acre)	48 (acres)	48 (acres)	***48 (acres)***
Buried Process Water Line	0 (acre)	8 (acres)	8 (acres)	***8 (acres)***
Carol Shop Facility[e]	27 (acres)	0 (acre)	0 (acre)	***0 (acre)***
Second Satellite Facility	0 (acre)	10 (acres)	0 (acre)	***10 (acre)***
Long-term Topsoil Stockpiles	3 (acres)[f]	3 (acres)[f]	3 (acres)	***3 (acres)***
Total Acres Disturbance[g]	**40**	**1,315**	***818***	***1,315***

[a] Only activities that would occur due to selection of the No Action Alternative are represented. Disturbances would occur during reclamation of a portion of the AML ***R***oad and the Carol Shop facility, including redistribution of existing topsoil stockpiles.

[b] Disturbance for new and upgraded existing primary roads would be the full 60-foot-wide ROW during construction and would include disturbance for power lines and pipelines adjacent to the road. Disturbance for primary roads would be 30 feet wide during operation. Except for the AML ***R***oad, existing primary roads that currently are greater than the projected operational width of the Project would be reclaimed back to 30 feet wide.

[c] Disturbance for secondary roads would be the full 40-foot-wide ROW during construction and would include disturbance for power lines and pipelines adjacent to the road. Disturbance for primary roads would be 15 feet wide during operation.

[d] Includes 2-track roads associated with monitoring well rings and previously existing 2-track roads outside of mine units that would remain within the GHPA.

[e] Disturbance associated with the Carol Shop facility (26.7 acres) would be reclaimed under the No Action Alternative.

[f] Approximately 2.6 acres of topsoil piles currently existing in the GHPA would be used for reclamation of the Carol Shop Road and the Carol Shop facility. Does not include long-term topsoil stockpiles within mine unit boundaries.

[g] Discrepancies in totals are due to rounding.

Table 2-7 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative	*BLM-Preferred Alternative*
Amount of Disturbed Lands	Least impact. Reclamation of approximately **40** acres of existing disturbance.	Most impact. Approximately **1,315** acres would be disturbed.	Less disturbance than the Proposed Action. Approximately ***818*** acres would be disturbed.	***Same as the Proposed Action.***
Air Quality	Least impact. Emissions of priority pollutants would be below regulatory thresholds, and emissions of approximately ***24,405*** tons of greenhouse gases would occur ***each year*** during the reclamation of **40** acres over 1 year.	Most impact. Emissions of priority pollutants would be below regulatory thresholds, and ***maximum*** emissions of approximately ***223,985*** tons of greenhouse gases would occur ***each year*** during the 25-year life of the Project.	Less impact than the Proposed Action. Emissions of priority pollutants would be below regulatory thresholds, and ***maximum*** emissions of approximately ***223,610*** tons of greenhouse gases would occur ***each year*** during the 25-year life of the Project.	***Same as the Proposed Action.***
Cultural Resources and Native American Concerns	Least impact. Reclamation of approximately **40** acres of previously disturbed areas would not impact historic properties, and would be unlikely to impact unanticipated discoveries.	Most impact. Three historic properties would be affected, and there would be the potential for direct impacts to unanticipated discoveries from a maximum of **1,315** acres of disturbance.	Less impact than the Proposed Action. Three historic properties would be affected and there would be less potential for direct impacts to unanticipated discoveries from a maximum of ***818*** acres of disturbance.	***Similar to the Proposed Action, with the potential to reduce impacts through Annual Development Planning.***
Geology				
Geologic Hazards	No impact.	Most impact. Potential hazards from disturbing **7.6** acres of existing landslide deposit, undercutting slopes greater than **25** percent on **100** acres. There would be a slight risk of increases in seismic activity from deep water disposal.	Same as the Proposed Action. While less disturbance within mine units would occur, construction in areas of existing landslide deposit and slopes greater than **25** percent would require additional precautions that are likely to not reduce disturbance in these areas. There would be a slightly higher risk of increases in seismic activity from deep water disposal, as surface disposal would be reduced.	***Similar to the Proposed Action, with the potential to reduce impacts through Annual Development Planning.***

Table 2-7 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative	***BLM-Preferred Alternative***
Mineral Resources	No impact.	Most impact. The ***Project*** would ***reduce access to*** other mineral resources ***within the GHPA*** during the life of the Project. ***However, because there is a low potential for the occurrence of other minerals, the impact would be limited.*** The removal of **25** to **62.5** million pounds of uranium would occur.	Same as the Proposed Action.	***Same as the Proposed Action.***
Land Use	No impact.	No impact. Land ownership or Special Management Areas would not be impacted.	Same as the Proposed Action.	***Same as the Proposed Action.***
Livestock Grazing	Least impact. Additional forage would be available from reclamation of approximately **40** acres of existing disturbance.	Most impact. Disturbance associated with the Project would result in impacts to **1,315** acres, and fencing would restrict livestock access to **977** acres within mine units on 3 BLM grazing allotments, resulting in the loss of **61** animal unit months over the 25-year life of the Project.	***Same as the Proposed Action.***	***Same as the Proposed Action.***
Noise	Least impact. Noise associated with reclamation activities would be minimal and would be short-term.	Most impact. Noise impacts would be greatest during the construction phase of the Project. Impacts during operations would consist mostly of vehicle traffic noise. The absence of noise-sensitive receptors in the GHPA would result in negligible impacts.	Less impact than the Proposed Action. Noise from traffic during Project operation would be reduced due to approximately ***155*** fewer large truck trips per year ***to the Smith Ranch-Highland facility, and a reduction of up to 441 trips per year for transport of waste brine.***	***Same as the Proposed Action during periods when no additional on-site processing is implemented. There would be up to 155 fewer large truck trips for each full year that additional on-site processing occurred.***

Table 2-7 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative	*BLM-Preferred Alternative*
Paleontological Resources				
Fossil Resources	Least impact. The potential for exposing fossil-bearing formations during reclamation of approximately **40** acres of existing disturbance is low.	Most impact. Surface disturbance with high potential to expose and impact fossil resources would occur on **1,114** acres within the GHPA.	Less impact than the Proposed Action. Surface disturbance with high potential to expose and impact fossil resources would occur on ***659*** acres within the GHPA. Additionally, the likelihood of exposing fossil-bearing formations would be reduced by eliminating excavation associated with drilling mud pits.	***Similar to the Proposed Action, with the potential to reduce the area and intensity of impacts through Annual Development Planning.***
Public Health and Safety				
Radiological Exposure	No impact. Long-term monitoring of background radiation from previous mining activities would continue.	Most impact. The highest estimated dose of radiation to surrounding communities would be **7** millirem/ year (7 percent of limit listed in 10 CFR Part 20). Radiation also would be monitored according to U.S. NRC rules; therefore, impacts would be low.	Same as the Proposed Action.	***Same as the Proposed Action.***

Table 2-7 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative	***BLM-Preferred Alternative***
Hazardous Materials and Waste	Least impact. Any radiologically contaminated waste generated by reclamation of approximately **40** acres, including the Carol Shop facility, would be disposed of according to existing permits.	Most Impact. On-site storage of hazardous materials would include an estimated maximum of **6,000** gallons of diesel fuel and gasoline, **100** short tons of sulfuric acid, and **10** short tons of sodium hydroxide. Accidents during the transportation of ***chemicals*** could occur an estimated 0.04 times during the Project. Accidents during the transportation of uranium-laden resin could occur an estimated 0.58 times during the Project.	Less than the Proposed Action. On-site storage of hazardous materials would be the same as for the Proposed Action. Accidents during the transportation of hazardous ***chemicals*** could occur an estimated 0.05 times during the Project. Accidents during the transportation of uranium-laden yelllowcake slurry could occur an estimated 0.21 times during the Project. ***Accidents for transporting radioactive waste could occur an estimated 0.14 times during the Project.*** The accident rate**s** for the transportation of uranium-laden ***materials*** would decline as the result of fewer trips between the Gas Hills Facility and the Smith Ranch-Highland facility ***and between the Gas Hills facility and the disposal site in Blanding, Utah***.	***Less than the Proposed Action.*** ***On-site storage of hazardous chemicals would be the same as the Proposed Action.*** ***Accidents during transportation of hazardous chemicals and radioactive wastes would be the same as for the Proposed Action. Accidents during transport of uranium laden resin or yellowcake would be less than the Proposed Action but greater than the RPA.***
Recreation	Least impact. Recreational activities could occur on approximately 40 acres of reclaimed land.	Most impact. Impacts most likely to occur would be a reduction in wildlife viewing and hunting due to animal displacement from Project-related noise. Historical uranium mining and no developed recreational facilities in the GHPA have limited current recreation, and would result in a low impact to recreation.	Less impact than the Proposed Action. The same number of roads would be constructed as for the Proposed Action, but **193** fewer heavy truck trips would occur, which would result in less noise and less reduction in wildlife viewing and hunting due to animal displacement.	***Less impact than the Proposed Action during periods when additional on-site processing is implemented.***

Table 2-7 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative	***BLM-Preferred Alternative***
Socioeconomic Conditions				
Population, Employment, and Income	Least impact. No new jobs or households would be created.	Less impact than the RPA. **148** new jobs would be created, and **58** new households would be created.	Most impact. **166** new jobs would be created and **68** new households would be created.	***More impact than the Proposed Action but less impact than the RPA.***
Environmental Justice	No disproportionate impact to poorer communities.	No disproportionate impact to poorer communities.	No disproportionate impact to poorer communities.	***No disproportionate impact to poorer communities.***
Soils	Least impact. The reclamation of existing disturbance, including redistribution of long-term topsoil stockpiles, would improve soil productivity on approximately 40 acres.	Most impact. Approximately **1,315** acres of topsoil and biological crusts would be disturbed. Impacts to sensitive soils within mine units (**508** acres of water erodible soils, **79** acres of compaction prone soils, **297** acres of soils with low revegetation potential, **9** acres of shallow soils, and **197** acres of stony-rocky soils) would occur. The potential for mixing topsoil and subsoil would occur from any excavation. Mixing of topsoil and subsoil, as well as compaction, also would be likely from cross-country vehicular travel.	Less impact than the Proposed Action. Approximately ***818*** acres of topsoil and biological crusts would be disturbed. The reduction of disturbance within mine units would maintain topsoil viability, and reduce direct impacts to sensitive soils than the Proposed Action. Additionally, the potential to mix topsoil and subsoil would be reduced by eliminating excavation associated with drilling mud pits, and by eliminating cross-country vehicular travel. Elimination of cross-country vehicular travel also would reduce soil compaction.	***Less impact than the Proposed Action. The potential disturbance under the BPA would be the same as for the Proposed Action, however, the area and intensity of impact could be reduced through Annual Development Planning.***
Transportation	Least impact. No new roads would be constructed. Additional traffic would be as a result of the reclamation of **1.8** miles of roads within the GHPA. Travel volume would not change from current levels.	Most impact. Approximately **23** miles of new primary or secondary roads would be constructed. Traffic on roads to the GHPA would increase by a maximum average of **27** heavy and **56.7** light truck trips per day from construction and operation traffic.	Less impact than the Proposed Action. There would be no difference in miles of roads constructed, but heavy truck trips would decline to **26.5** trips per day as a result of fewer loads of uranium-laden material transported to the Smith Ranch-Highland facility and more loads of chemicals transported to the GHPA.	***Less impact than the Proposed Action. The BPA estimates are based on construction of the same length of road in miles as the Proposed Action but heavy truck trips would be reduced by 0.4 each day that additional on-site processing is implemented.***

Table 2-7 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative	*BLM-Preferred Alternative*
Vegetation	Least impact. The reclamation of existing disturbance would improve the vegetation cover and community diversity on approximately **40** acres.	Most impact. Disturbance would occur on **743** acres of shrub-dominated vegetation, which would take ***up*** to ***20*** years to reestablish. Disturbance also would occur on **15** acres on wetlands.	Less impact than the Proposed ***Action***. Disturbance would occur on **458** acres of shrub-dominated vegetation, which would take ***up*** to ***20*** years to reestablish. Additionally, 8 acres of wetlands would be disturbed.	***Less impact than the Proposed Action. Disturbance could occur over the same area, with the potential to reduce the area and intensity of impacts through implementation of the Annual Development Plan.***
Noxious Weeds and Invasive Species	Least impact. The reclamation of existing disturbance would include control o noxious weeds and invasive species on approximately **40** acres.	Most impact. The disturbance of **1,315** acres would have the potential to allow establishment of noxious weeds and invasive species.	Less impact than the Proposed ***Action***. The disturbance of **783** acres would have the potential to allow establishment of noxious weeds and invasive species.	***Less impact than the Proposed Action. Disturbance could occur over the same area as the Proposed Action, with the potential for improved control of noxious weeds and invasive species through implementation of the Annual Development Plan.***

Table 2-7 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative	*BLM-Preferred Alternative*
Special Status Plant Species	No impact.	Most impact. Disturbance from the Project has the potential to directly impact individuals of the following species: Cedar rim thistle; and Rocky Mountain twinpod. The Project also has the potential to indirectly impact, through the spread of noxious weeds and invasive plant species, fugitive dust, or changes in surface water flow, the following species: Persistent sepal yellowcress; Cedar rim thistle; Beaver rim phlox; Rocky Mountain twinpod; and Limber pine.	Less impact than the Proposed ***Action***. The same species as listed for the Proposed ***Action*** could be directly or indirectly impacted; however, reduced disturbance within the mine units would reduce the potential for impacts to these species.	***Less impact than the Proposed Action. Disturbance could directly impact individuals of the same species as listed for the Proposed Action over the same areas, with the potential to reduce the area or intensity of impacts through implementation of the Annual Development Plan.***
Visual Resources	Least impact. The reclamation of approximately **40** acres would temporarily cause minimal impacts to visual resources.	Most impact. Visual resources would be impacted during Project construction and would be moderately impacted during Project operation.	Same as the Proposed Action.	***Same as the Proposed Action.***

Table 2-7 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative	*BLM-Preferred Alternative*
Water Resources				
Surface Water	Least impact. Reclamation of approximately **40** acres of previous disturbance within the GHPA would restore surface contours to approximate original drainage patterns.	Most impact. Disturbance would occur on **1,315** acres, including **15** acres of wetlands. Roads and other construction within waterways could alter existing channel geometry and cause additional headcutting, bank failure, and sedimentation. The potential of a spill of uranium-laden resin into a river during transportation would be 0.008 spills in 25 years.	Less impact than the Proposed ***Action***. Disturbance would occur on ***818*** acres, including **8** acres in wetlands. The potential for impacts to waterways would be reduced. Annual development planning would encourage avoidance of, and would reduce the potential for road development in, waterways. The potential of a spill of yellowcake slurry into a river during transportation would be 0.002 spills in 25 years.	***Less impact than the Proposed Action. Disturbance could occur on the same number of acres, with the potential to reduce the area or intensity of impacts through implementation of the Annual Development Plan. The potential of a spill of uranium-laden material into a river would be the same as the Proposed Action except during periods when additional on-site processing is implemented, at which point the potential would be the same as under the RPA.***
Groundwater	Least impact. No groundwater impacts would occur beyond those from past mining activity.	Most impact. Groundwater quality and quantity would be impacted by the ISR process during mine operation. Impacts would be restricted to the area within mine units and corresponding monitoring well rings (2,122 acres). Groundwater quantity would be restored to pre-mining levels prior to mine closure. Groundwater quality would be restored to pre-mining conditions, or to class of use based on WDEQ guidelines.	Same as the Proposed Action.	***Same as the Proposed Action.***

Table 2-7 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative	*BLM-Preferred Alternative*
Water Use	No impact.	Most impact. Consumptive use of groundwater for ISR mining would occur; however, this use would not impact holders of existing water rights within the GHPA.	Same as the Proposed Action.	***Same as the Proposed Action.***
Wild Horses	No impact within the GHPA.	No impact within the GHPA.	No impact within the GHPA.	***No impact within the GHPA.***
Wildlife and Fisheries (incremental acres of habitat disturbed)				
Big Game, Small Game, Raptors, Migratory Birds, Reptiles, and Amphibians	Least impact. Reclamation of approximately **40** acres of previous disturbance within the GHPA would have minimal impact.	Most impact. Approximately **1,206** acres of habitat would be disturbed.	Less impact than the Proposed Project. Approximately **733** acres of habitat would be disturbed.	***Similar to the Proposed Action with the potential to reduce area or intensity of impact through implementation of the ADP.***
Special Status Wildlife Species (incremental acres of habitat disturbed)				
White-tailed Prairie Dog	No impact.	Most impact. Approximately **5.6** acres of habitat disturbance.	Less impact than the Project. Approximately **3.0** acres of habitat disturbance.	***Similar to the Proposed Action with the potential to reduce area or intensity of impact through implementation of the ADP.***
Pygmy Rabbit	No impact.	Most impact. Approximately **93** acres of habitat disturbance.	Less impact than the Project. Approximately **65** acres of habitat disturbance.	***Similar to the Proposed Action with the potential to reduce area or intensity of impact through implementation of the ADP.***
Sensitive Bat Species	No impact.	Most impact. Approximately **1,206** acres of habitat disturbance.	Less impact than the Project. Approximately **733** acres of habitat disturbance.	***Similar to the Proposed Action with the potential to reduce area or intensity of impact through implementation of the ADP.***

Table 2-7 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative	***BLM-Preferred Alternative***
Ferruginous Hawk	No impact.	Most impact. Approximately **1,206** acres of habitat disturbance.	Less impact than the Project. Approximately **733** acres of habitat disturbance.	***Similar to the Proposed Action with the potential to reduce area or intensity of impact through implementation of the ADP.***
Burrowing Owl	No impact.	Most impact. Approximately **834** acres of habitat disturbance	Less impact than the Project. Approximately **510** acres of habitat disturbance.	***Similar to the Proposed Action with the potential to reduce area or intensity of impact through implementation of the ADP.***
Greater sage-grouse	No impact.	Most impact. Approximately **422** acres of habitat disturbance.	Less impact than the Project. Approximately **260** acres of habitat disturbance.	***Similar to the Proposed Action with the potential to reduce area or intensity of impact through implementation of the ADP.***
Brewer's Sparrow, Loggerhead Shrike, Sage Sparrow, Sage Thrasher	No impact.	Most impact. Approximately **1,206** acres of habitat disturbance.	Less impact than the Project. Approximately **733** acres of habitat disturbance.	***Similar to the Proposed Action with the potential to reduce area or intensity of impact through implementation of the ADP.***
Mountain Plover	No impact.	Most impact. Approximately **1.3** acres of habitat disturbance.	Less impact than the Project. Approximately **0.8** acre of habitat disturbance.	***Similar to the Proposed Action with the potential to reduce area or intensity of impact through implementation of the ADP.***
Northern Leopard Frog, Great Basin Spadefoot	No impact.	Most impact. Approximately **15** acres of habitat disturbance.	Less impact than the Project. Approximately **8** acres less habitat disturbance compared to the Proposed Action.	***Similar to the Proposed Action with the potential to reduce area or intensity of impact through implementation of the ADP.***

Table 2-7 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative	*BLM-Preferred Alternative*
Sensitive Species	No impact.	Most impact. The Project has a low potential to impact the following species: White tailed prairie dog; Pygmy rabbit; BLM sensitive bat species; Ferruginous hawk; Burrowing owl; Greater sage-grouse; Brewer's sparrow; Loggerhead shrike; Sage sparrow; Sage thrasher; Mountain plover; Northern leopard frog; and Great Basin spadefoot.	Same as ***the*** Proposed Action.	***Same as the Proposed Action.***